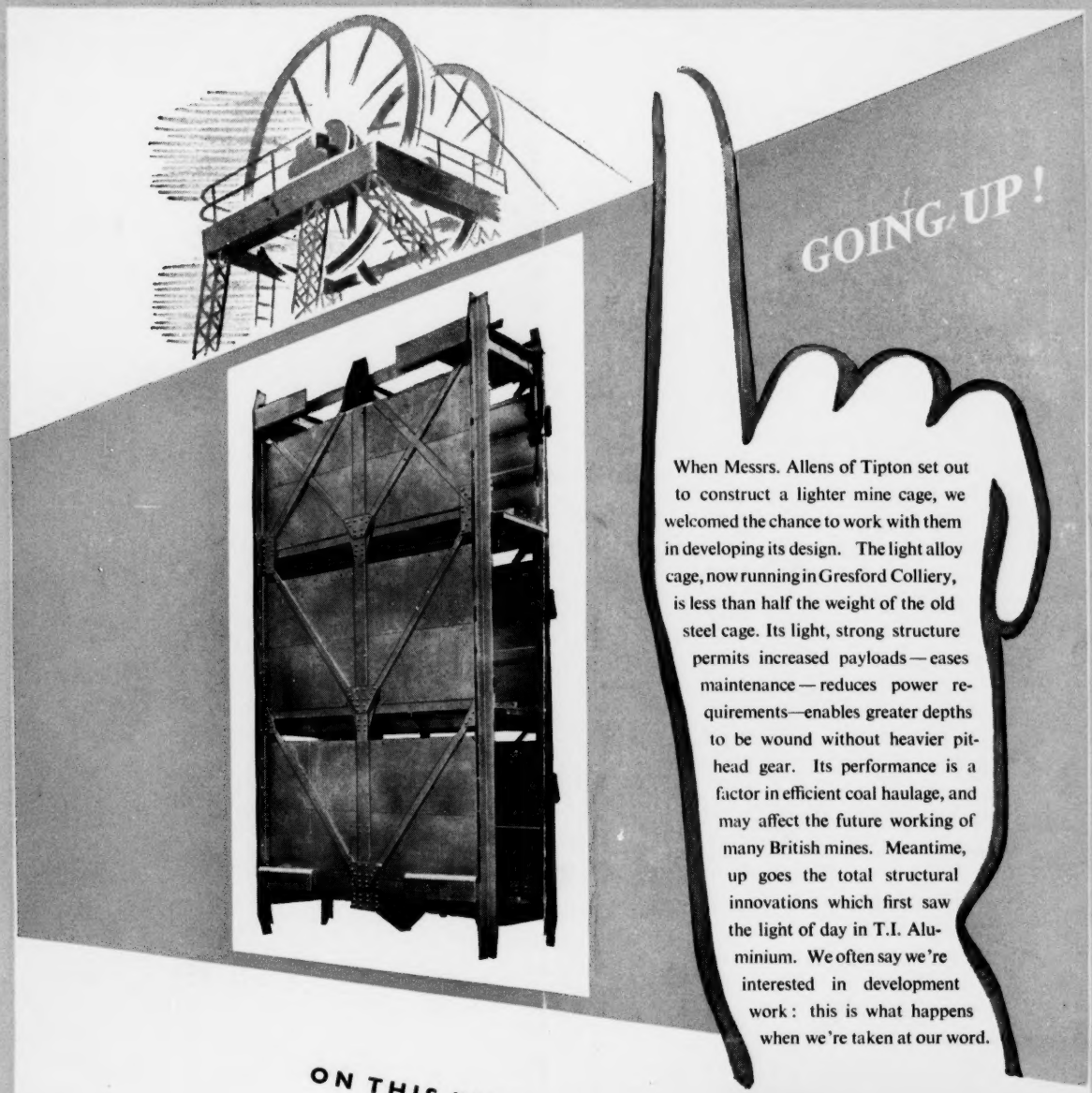
The Mining Journal

Established 1835 — Railway & Commercial Gazette

Vol. CCXLI No. 6160 — LONDON, SEPTEMBER 11, 1953 — PRICE 8d



When Messrs. Allens of Tipton set out to construct a lighter mine cage, we welcomed the chance to work with them in developing its design. The light alloy cage, now running in Gresford Colliery, is less than half the weight of the old steel cage. Its light, strong structure permits increased payloads — eases maintenance — reduces power requirements—enables greater depths to be wound without heavier pithead gear. Its performance is a factor in efficient coal haulage, and may affect the future working of many British mines. Meantime, up goes the total structural innovations which first saw the light of day in T.I. Aluminium. We often say we're interested in development work: this is what happens when we're taken at our word.

ON THIS KIND OF JOB...

PUT Aluminium FIRST AND TI IN FRONT OF IT

T.I. ALUMINIUM LTD., TYSELEY, BIRMINGHAM. Tel.: ACOCKS GREEN 3333.

ALUMINIUM AND ALUMINIUM ALLOY INGOT, SLABS, BILLETS, SHEET, STRIP, TUBES AND EXTRUSIONS TO ALL COMMERCIAL, A.I.D. AND LLOYD'S SPECIFICATIONS.

A COMPANY

PIKROSE
DOUBLE DRUM
SCRAPER HOISTS

F.L.P. Electric

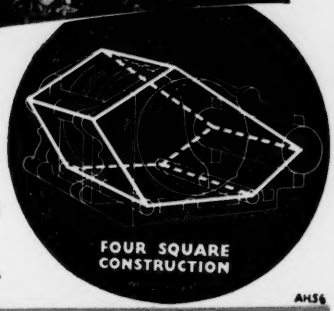
Ideal for

- **SKIP SCRAPING**
- **STOWING**
- **DRIFTING**
- **PIT HEAPS**

Four different sizes and H.P.'s available.

The illustrations show a PIKROSE S.3 F.L.P. Electric Scraper Hoist at work in a British Coal mine. The machine is rated 35/75 H.P.

If required the drive can quickly and easily be interchanged for Compressed-Air useage.



AH56

Manufactured by **AUSTIN HOPKINSON & CO., LTD.** *Mining Engineers*

DELTA WORKS . AUDENSHAW . LANCASHIRE . ENGLAND

TELEGRAPHIC ADDRESS: PRAETOR, AUDENSHAW. TELEPHONE: 1368 DROYLSDEN

Triefus
DIAMOND DRILL BITS
† Effective sludge clearance
† The diamond pattern ensures that the sludge is cleanly removed from the working face of the bit.
TRIEFUS & CO. LTD. (WORKS) BELSIZE LANE, LONDON, N.W.2
Telephone: Primrose 3368 Telegrams and Cables: Resets, London

DENVER *coal flotation*

Over 34,000 Denver "Sub-A" Flotation Machines are in use throughout the world. Our illustration shows a recent installation carried out by Messrs. Simon-Carves Ltd. In this coal preparation plant, two Denver Super Agitators are conditioning the slurry prior to flotation.

Denver "Sub-A" Flotation Machines are in universal use because they are adaptable to all kinds of flotation problems and possess the correct fundamental principles necessary for high recovery. Rugged simplicity of construction ensures reliability and long service even under the most arduous conditions.

Write for Bulletin F10-B50.

STANDARD RELIABLE 24 HOUR SERVICE EFFICIENT

"The firm that makes its friends happier, healthier, and wealthier"

DENVER EQUIPMENT CO., LTD.
SALISBURY HOUSE • LONDON, EC2, ENGLAND

DENVER 17, COLORADO: P.O. Box 5268
NEW YORK CITY 3, N.Y.: 4114 Empire State Bldg.
CHICAGO 1: 1123 Bell Bldg., 307 N. Michigan
TORONTO, ONTARIO: 220, Bay Street
VANCOUVER, B.C.: 305 Credit Foncier Bldg.
MEXICO, D.F.: Edificio Pedro de Gante, Gante 7
LONDON, EC2, ENGLAND: Salisbury House
JOHANNESBURG, S. AFRICA: 8 Village Road
RICHMOND, AUSTRALIA: 530 Victoria Street

Telephone
MONarch 0445
Cables
DECOLON-LONDON

TIB, 58

TEXOLEX

SAFETY HELMETS

TEXOLEX

Produced to World Standards

LIGHT AND HEAVYWEIGHT MODELS AVAILABLE

STANDARD DESIGN

- SCIENTIFICALLY DESIGNED
- HIGH PRESSURE MOULDED SHELL (Laminated Fabric)
- LIGHTWEIGHT, IMMENSE STRENGTH
- IMPERVIOUS TO WATER AND HEAT
- ELECTRICALLY NON-CONDUCTING

If you require a Safety Hat to withstand a 40 foot-pound impact load enquire from:—

MALCOLM CAMPBELL (PLASTICS) LTD

5 GREAT JAMES STREET - LONDON, W.C.I, ENGLAND
Telephones - - - Holborn 3623 • 0931 - Chancery 8383

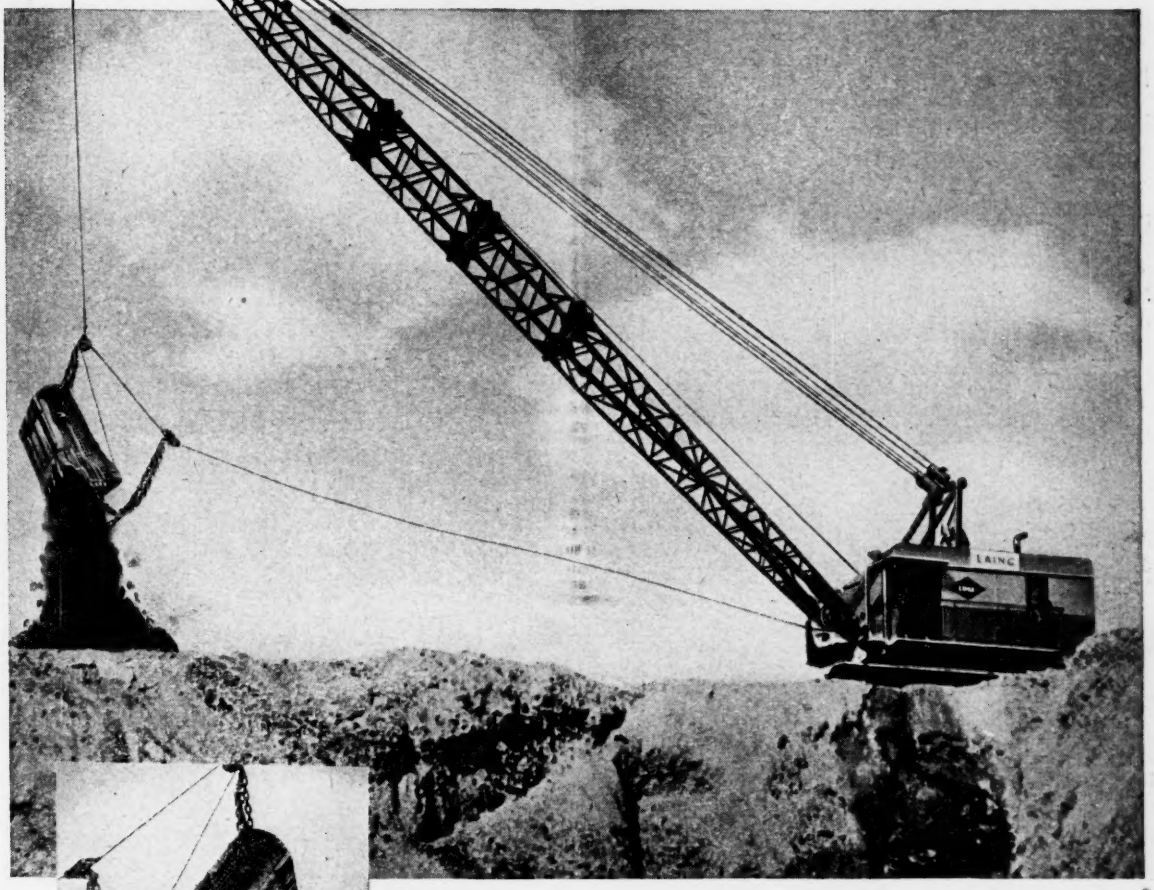
WOLVERHAMPTON DIAMOND DIE & TOOL Co. Ltd.

BOARTS and INDUSTRIAL DIAMONDS Exporters

II HATTON GARDEN, LONDON, E.C.I

Telephone: **HOLborn 3017** *Cables:* **Pardimon, London**

LIMA leads for stability



THIS BUCKET ADDS EXTRA EFFICIENCY

Hendrix Dragline buckets have a large saving in dead-weight, allowing the use of a larger size bucket on an existing excavator. Ruggedly constructed they will increase production in all operating conditions. Now built in Britain and available in 2, 2½, 3 and 3½ cu. yd. sizes.

ONE of the strongest points about the Lima 1201 dragline is its stability. It enables you to handle long booms at low angles. Look over a Lima and you'll see many other strong points which explain why these excavators are putting up remarkable output records on some of the toughest jobs in earth-moving.

Jack Olding & Co. Ltd. have arranged for the manufacture of LIMA 1201s by the North British Locomotive Company; the first of these machines will shortly be at work helping to speed the production of open-cast coal.

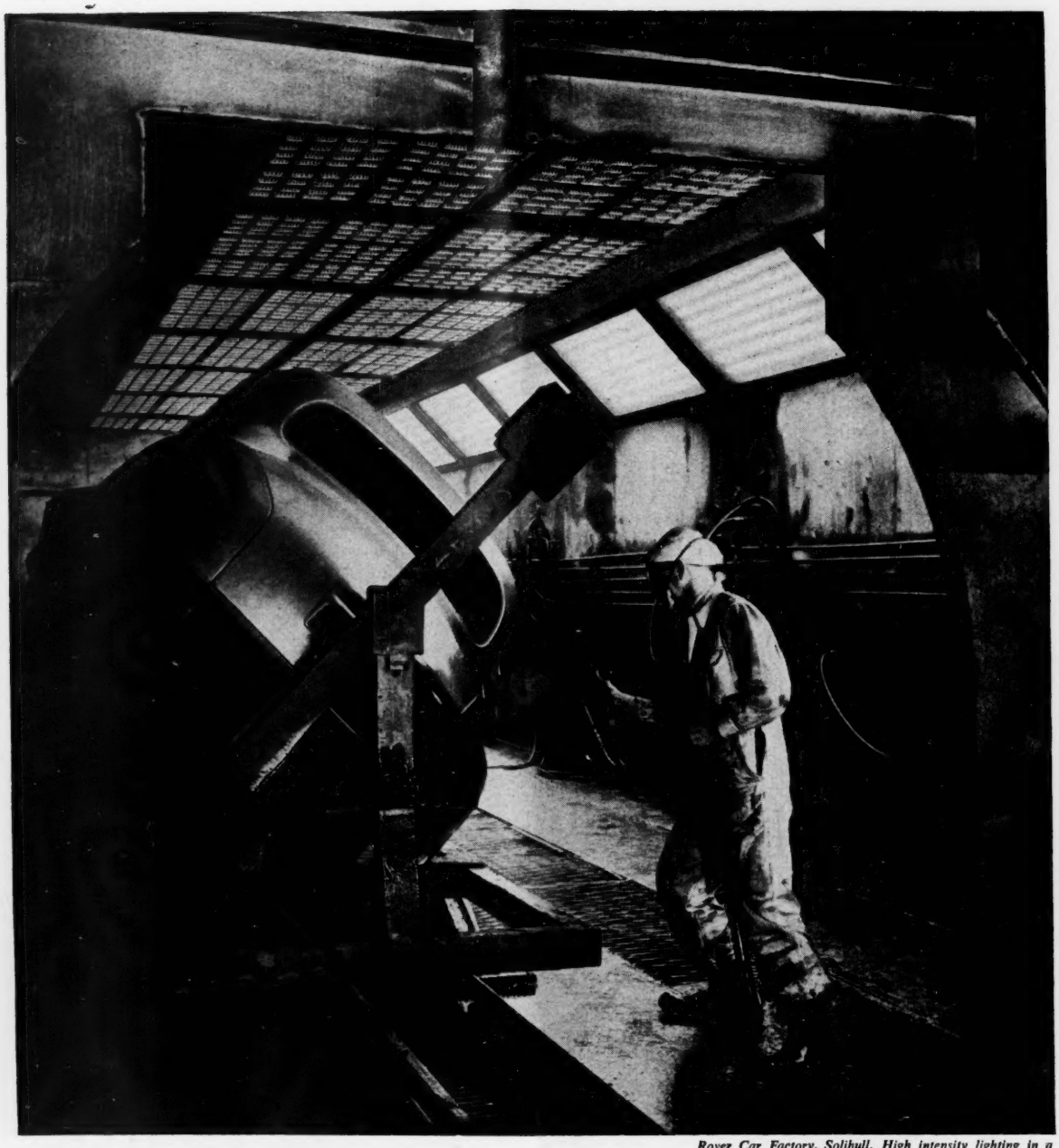
Distributors for Lima Excavators and Hendrix Buckets

JACK OLDING & CO. LIMITED

HATFIELD · HERTFORDSHIRE · ENGLAND

Telephone: Hatfield 2333

SCOTLAND: JACK OLDING & CO. (SCOTLAND) LTD., COUPAR ANGUS, PERTHSHIRE



Rover Car Factory, Solihull. High intensity lighting in a body spray tunnel by fluorescent lamps in a glazed enclosure.

Tailored for the job

The lighting of many processes is vital to the smooth and rapid flow of work and to the quality of the finished product. For example, poor lighting could make a spray tunnel into a bottle-neck — each job taking a little too long, a little portion missed, a return to the spray line — and so the whole production line marks time. Whatever form it takes, good lighting not only helps to provide a satisfactory working environment but is an active production tool.

Fluorescent lighting is as good as daylight — only more consistent. It is efficient; it is economical; and it is *flexible*. You can 'tailor' it, easily and exactly, to the special requirements of production at all stages.

HOW TO GET MORE INFORMATION

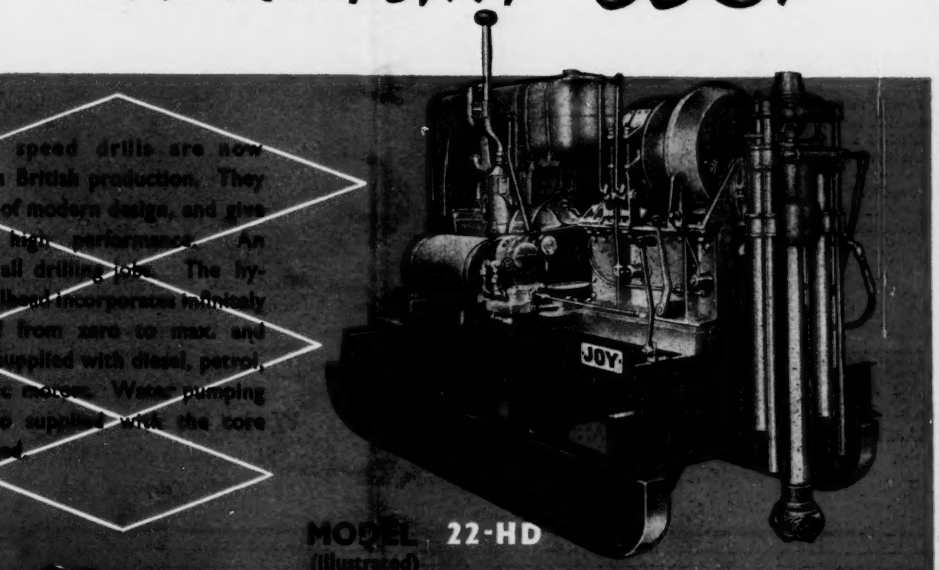
Your Electricity Board will be glad to advise you on how to use electricity to greater advantage — to save time, money, and materials. The new Electricity and Productivity series of books includes one on lighting — "Lighting in Industry". Copies can be obtained, price 9/- post free, from E.D.A., 2 Savoy Hill, London, W.C.2, or from your Area Electricity Board.

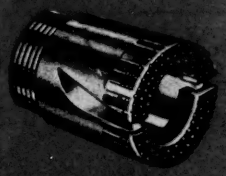
Electricity for PRODUCTIVITY

Issued by the British Electrical Development Association

MAXIMUM FOOTAGE AT MINIMUM COST

These high speed drills are now available from British production. They are portable, of modern design, and give consistently high performance. An essential on all drilling jobs. The hydraulic swivelhead incorporates infinitely variable feed from zero to max. and they can be supplied with diesel, petrol, air or electric motors. Water pumping units are also supplied with the core drills if desired.





MODEL 22-HD
(illustrated)
Capacity of 2000 ft. using EX fittings. 1000 ft. using NX fittings — also

MODEL 12-B
having a capacity of 1000 ft. using EX fittings. 500 ft. using NX fittings.

TRUCO DIAMOND DRILL BITS available in all standard sizes and include Coring, Blast Hole, Concave, Pilot and Casing Bits with reamer shells in corresponding sizes, or to individual specification.

Joy

High Speed DIAMOND Core Drills & Equipment

JOY PROVIDE FAST & EXPERT DIAMOND RESETTING SERVICE

Consult a Joy Mining Engineer ABOUT THESE OTHER JOY PRODUCTS

JOY-SULLIVAN LTD
GREENOCK BATTERY PARK
Telephone - Accounts - Sales - Greenock 2438
Works - Greenock 2086 Telegrams - Joyloader

LONDON
Expert - 6 Clarges Place, W.1
Telephone - Mayfair 3983
Grams - Joyloader, Audley

LONGWALL COALCUTTERS . . . . . SHORTWALL COALCUTTERS . . . . GLOSTER GETTER CUTTER LOADERS . . . COAL AUGERS . . . ROCK LOADERS . . . . . SCRAPER CHAIN CONVEYORS . . . . DRILL RIGS, etc. . . . SULMET PICKS

Protection plus . . .

Drum Stuffed, Greased Green Semi-Chrome Uppers, Leather Lined Vamps, Felt Lined Tongues, External Steel Toecaps, Leather Soles screwed, stitched and bobbed, Lip Toe Plates, Leather Heels, Steel Heel Tips.

TOTECTORS Safety Boots and Shoes are manufactured to British Standards Institute Specification.

TOTECTORS (Regd.
SAFETY BOOTS AND SHOES

These new style armoured mining boots have been designed specially for the protection of the feet. They stand up to surprisingly heavy blows and wear longer by virtue of the anti-abrasion qualities of the external steel toecaps.

WILKINS & DENTON LTD.
51 & 52 Woburn Place, London, W.C.1
Telephone: LANgham 7061

Premier
PLANT AND HIRE CO., LTD
48, BURLINGTON ROAD, ISLEWORTH, MIDDLESEX

TRACTORS & EXCAVATORS

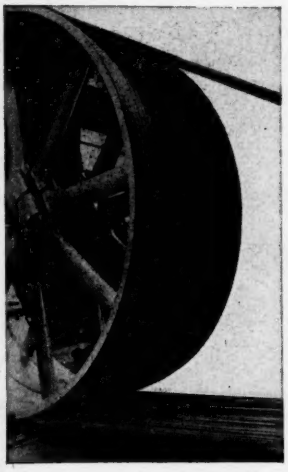
Ransome & Rapier Model 462 Excavator, 1947 machine. Recently overhauled. Fitted with 60ft. lattice jib and 1 cube yard drag line bucket. Driven by 5 cylinder McLaren diesel engine with petrol engine starter.

H.D.14 Allis Chalmers Tractor with Garwood double drum power control unit. In good order as lying.

PNEUMATIC TOOLS

C.P.4 high lift sump pumps with delivery hose.
Pile driver attachments for Ingersoll-Rand breakers.
Rock drills, concrete breakers, rivet hammers, circular and chain saws.
Send for current stock list and prices.

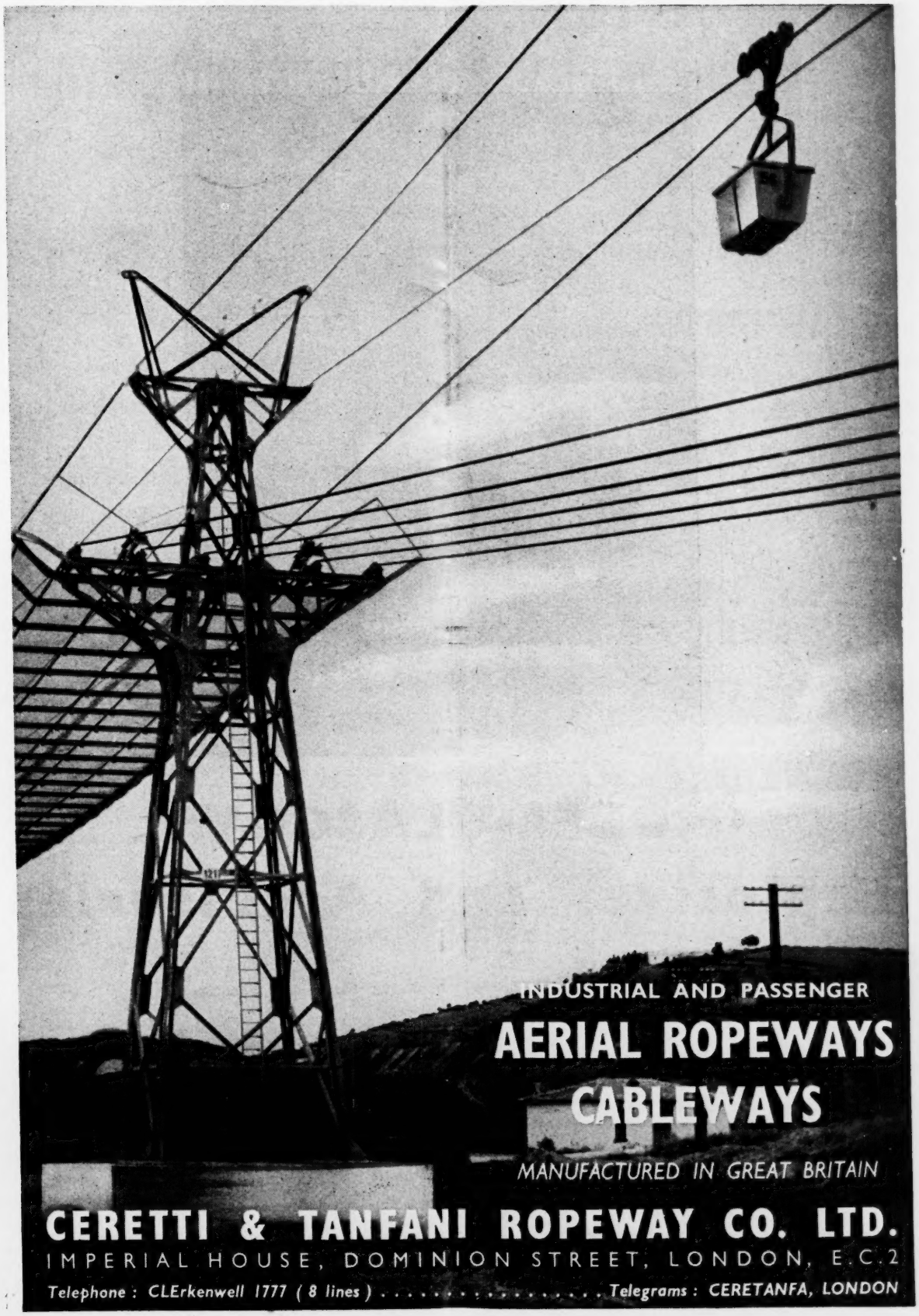
WIGGLESWORTHS
for POWER TRANSMISSION EQUIPMENT

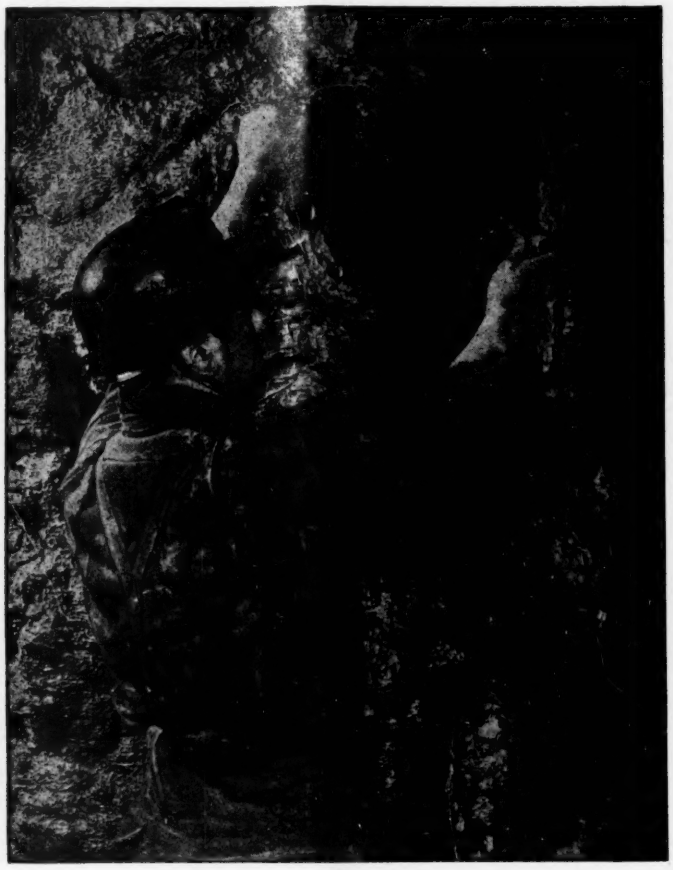


Makers of
"TEXROPE"
V
DRIVES

PROVED BEST BY TEST

FRANK WIGGLESWORTH & CO. LTD.
ENGINEERS
SHIPLEY YORKSHIRE


INDUSTRIAL AND PASSENGER
AERIAL ROPEWAYS
CABLEWAYS
MANUFACTURED IN GREAT BRITAIN
CERETTI & TANFANI ROPEWAY CO. LTD.
IMPERIAL HOUSE, DOMINION STREET, LONDON, E.C.2
Telephone : CLErkenwell 1777 (8 lines) . . . . . Telegrams : CERETANFA, LONDON



'NOBEL-GLASGOW' Explosives and Accessories

There is a 'Nobel-Glasgow' explosive for every blasting operation.

Users are invited to apply to the Nobel Division of Imperial Chemical Industries Limited for assistance with their problems.

IMPERIAL CHEMICAL INDUSTRIES LIMITED
NOBEL DIVISION, 25 BOTHWELL STREET, GLASGOW, C.2

ICI

N.44

Laying the foundations of a new industry

FOR THE LAST TWO AND A HALF YEARS, the Fowler Challenger Crawler Tractor has been laying foundations. Foundation-laying includes shifting earth, shale and rock, and this rugged, diesel-powered Challenger moves them with unrivalled efficiency and dispatch. It is already proving this in 27 different countries.

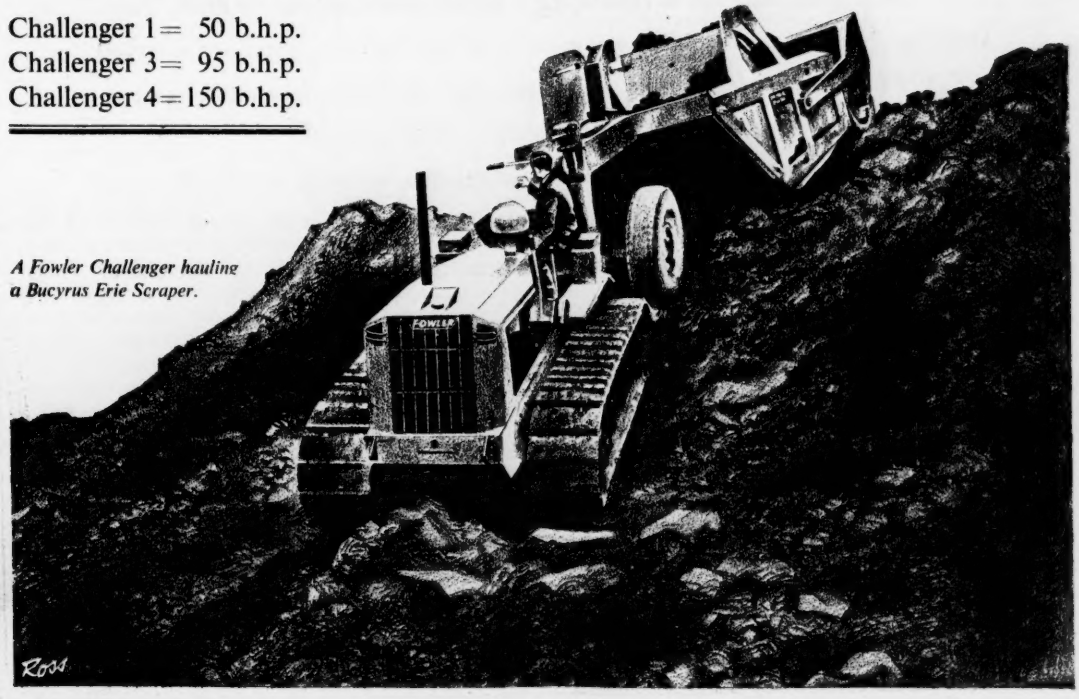
But the Challenger—the first all-British heavy-duty crawler—is a layer of foundations in more than one sense. It is one of a series of Fowler Crawlers, ranging in size from 50 to 150 horse power, which is already in production. Thus the skill and experience of one of Britain's oldest and most experienced engineering enterprises, in laying foundations all over the world, is building up a new industry in Britain.

FOWLER LEEDS **Challenger British Diesel Crawlers**

Products of the Marshall Organisation, Gainsborough, England

SOLE CONCESSIONAIRES FOR GREAT BRITAIN: THOS. W. WARD LTD., ALBION WORKS, SHEFFIELD 4

Challenger 1= 50 b.h.p.
Challenger 3= 95 b.h.p.
Challenger 4=150 b.h.p.



A Fowler Challenger hauling a Bucyrus Erie Scraper.

Pulsafe Faceshield

SIZES. Available in Cellulose Acetate of 0.02", 0.03", 0.04", 0.06", 0.08" thickness. With fronts 4", 6", 8", and 10" deep.

COMFORT. Headband size is adjustable. A leather sweatband can be fitted. Faceshield swivels above the head when not in use. Can be worn over correction spectacles.

VISIBILITY. Permits wide vision. Does not easily fog. The metal reinforcement on the edge of the cellulose acetate prevents distortion of the material.

PROTECTION. Gives protection against acid splashes, or flying particles of metal or stone.

ECONOMY. The Cellulose, when scratched, is easily replaced. Thus the Faceshield is economical in upkeep.

SAFETY PRODUCTS LTD.

44 HATTON GARDEN, LONDON, E.C.1. HOLBORN 5240

The Mining Journal

Established 1835

Vol. CCXLI No. 6160 LONDON, SEPTEMBER 11, 1953 PRICE 8d

CONTENTS

Notes and Comments	291	**Machinery and Equipment**	301
Four Decades of Accident Prevention on the Witwatersrand	293	**Metals, Minerals and Alloys**	303
How Long Will Our Existing Mineral and Fuel Resources Last	294	**The Mining Markets**	305
A Review of Chromite Resources—I	295	**Company News and Views**	306
Hydraulic Transport of Solids	296	Mufulira and Roan's Excellent Results; London Tin's Larger Net Income; Kinta Kellas Disappoints; Rand and O.F.S. Returns for August	
The Principles and Practice of Roof Bolting	298	**Company Shorts**	307
Reviews	300	**Company Announcements**	308
		Harmony Gold Mining Co. Ltd.	

Published by The Mining Journal Ltd., at 15 Wilson Street, Moorgate, London, E.C.2. MONarch 2567 Subscription £2 per annum

NOTES AND COMMENTS

Taking Stock

American Labour Day, which fell on Friday of last week, is now recognized in the United States as the beginning of a new industrial year, when vacation distractions are laid aside and approach to the serious business of life takes their place. While not so clearly marked in this country and elsewhere, the approach of autumn brings with it a general stocktaking, commercial, political and international.

In the wide field of international politics we have before us this week the result of the West German Elections, which have set Dr. Adeneur in a commanding position, not only in the Western Republic, but as the leader of what may prove to be a renaissant Germany. Considering the efforts to denigrate and oppose him in the Soviet dominated countries, the result may be regarded either as a major set-back to that way of life, or as a defiance likely to inflame the hostility of the Communist movement against the "capitalist" West. As against the possibility of definitely hostile action, we may set the fact that it is too late in the year to stage major aggression, at least on the experience of earlier wars, even if the Soviet internal position rendered such an arbitrament likely. In six months' time the situation may look different again.

At home we have had the T.U.C. Conference, the full results of which we have still to learn, but which may have serious repurcussions on the future programme of the Socialist Party when the Annual Meeting is held in Margate next month. Despite many anxieties, the industrial position in the United Kingdom may be regarded as generally favourable. The iron and steel industry, which is the bed-rock of our vital export trade is, as our special iron and steel correspondent reports, encouraging. The extreme Socialist idea of progressive nationalization, has, in the light of ascertained facts, had a definite set-back, and confidence among industrialists is undoubtedly strengthened.

In the United States there appears to be considerable divergence of expectation as to developments in the coming winter. Some recession upon the record breaking advances in the past year may be in prospect, but readjustment is not depression, and any apprehensions which do exist are due mainly to the Governmental strutting which exists in so many branches of industry. The policy of price support for so many domestic products, coupled with the continued rise in the cost of living, is criticized in the September issue of the *Guarantee Survey*, which calls attention to the acute over-supply of grains, the marketing quotas of tobacco and peanuts, the great carry over of cotton, and the price support situations in potatoes and dairy products, where butter has long been losing ground to margarine, and the difficulty of abandoning what was at first only a temporary device, but which like all such expedients liable to prove anything but temporary, is shown by the general inclination to shield the domestic producer from the effects of external competition as evidenced in the struggle to increase metal and mineral import duties.

Another future which will require watching is the great increase in consumer debt and in "buying on time" especially of automobiles, so marked before the 1929 crash.

Thus far, President Eisenhower's Fabian tactics appear to be working out successfully against the campaign of the old Republican elements in the party. What the outcome may be it is as yet impossible to judge, but to foreign observers, naturally very imperfectly informed about the complex of American affairs, it seems that a wide liberalization of trade must benefit United States industry as it certainly would do that of other countries with a large stake in expansion in international trade.

Another important development this week is the meeting in New York of the Governors of the World Bank and World Monetary Fund. The chairman of the World Bank, Mr. Eugene Black, gave a strong warning that present world trade balance was precarious and was achieved only by a general reduction of international commerce and for this state of affairs the United States was partly responsible. The artificial restrictions against foreign goods rendered the world, including the United States, poorer than it would be if foreign products had easier access to the U.S. markets. President Eisenhower in a message read at the opening of Wednesday's meeting reaffirmed his previous utterances in favour of liberalizing the United States economic policy and promised full administration support for the establishment and maintenance of sound money, the quickening of trade and the development of natural resources.

Effective action along the lines suggested by Mr. Black, following on the recommendation of Mr. Douglas in his report to President Eisenhower, would be one of the most encouraging international developments discernible to-day.

These then are some of the ideas which enevitably suggest themselves at this period of the year when a general stocktaking is in progress. Our conclusions may be coloured by our hopes, but these are certainly not altogether wishful thinking, and the general situation so far as the "capitalist" world is concerned is far more encouraging than it was a year ago.

Relaxation of Stockpiling

The United States Office of Defense Mobilization made an important announcement at the end of last week regarding the slowing down in the stockpiling of strategic materials for arms production. The possibility of such a development has been long discussed and in the case of tin, at least, widely believed to be in progress, and has been mainly responsible for the decline in tin prices during the second quarter of the year, and has been the mainspring for the increased efforts to bring about a more stable situation *vis à vis* of supply and demand by a resuscitation of a policy of quota restrictions and stockpiling.

The announcement of O.D.M. now substitutes an official statement for what has hitherto been a matter of speculation. According to a cable summary, stockpile buying will be concentrated on materials most vital to national defence. Six alloying materials, including nickel and cobalt, will be given high priority, but otherwise, though existing contracts will not be disturbed, there will be a prolongation of delivery dates, while any future contracts will generally be only for 12 months, and the general policy will be a temporary one until the O.D.M. has completed its current review of the stockpile goals. In the main, however, the O.D.M. policy implies the abandonment of June, 1954, stockpile dates for the completion of the objectives.

To some extent the position now adopted appears to be an interim one induced partly by the need for economy in order to avoid an autumn session of Congress to increase the legal level of national debt, but is also no doubt due to the general easing of the international political situation and the increasing liquidity of world supplies.

Also significant in this connection is the decision of the Council of O.E.E.C to cancel the full list of end-use prohibitions of copper and copper alloys imposed in September, 1951, due to the "present satisfactory situation of world supplies, which has enabled all member countries to remove their national end-use restrictions." While this decision is primarily applicable to copper, other metals in which world scarcity has been most pronounced are obviously even more directly involved.

The result of this general policy of relaxation is obviously likely to be of growing importance, both to producers and consumers of metals and minerals. For consumers it means the relaxation of anxiety, less necessity for inventory accumulations and the tying up of capital therein and increased use of the media for hedging future needs. For producers, it suggests the likelihood of a progressive reduction in the price of metals affecting, in varying degrees, those in which world supplies are in greater or less abundance. In fact it suggests the final liquidation of the Korean scare buying, and the gradual return towards pre-Korean price levels.

The somewhat cautious tone of the O.D.M. announcement is no doubt due in part, besides the desire for immediate economy, to the uncertainty of the terms of the U.S. Tariff Commission's report which is to be presented not later than next March, and which is expected to be decisive of the United States policy in regard to the liberalization of foreign trade and the possible amendment of the Buy American Act. On a short-term view immediate price trends will no doubt be largely influenced by the volume of Fall-trade business in the U.S. which should begin to reveal itself now the Labour Day is passed, but over a more extended period a less feverish situation should develop which should assist international trade and by stabilizing markets benefit also producers by the reduction of excessive commercial stocks, the possible liquidation of which generate uncertainty and anxiety.

There's Gold in Them Thar Hills!

The adventurer, whether by sea or land, is spurred on by the hope that one day he will strike it rich. The fisherman holds that "There are bigger fish in the sea than ever came out of it!"; the Western prospector is never tired of repeating the phrase which we have taken as our caption here. The Cornish miner maintains "There's more tin in Cornwall to-day than ever came out of it." With the sophistications of industrial concentration these glittering visions are less common than of yore but every now and then we are reminded that this optimism regarding riches still to reward the unquenchable searcher in the womb of Nature is not exhausted. It is true that, with the gradual disappearance of the great band of independent individual prospectors and the progressive investigation of surface mineral discoveries, attention is more directed to deep-level than to superficial ore occurrences. Our Western United States correspondent has referred from time to time to projects for the re-examination of old mines and the possibility that deposits either missed in earlier working, or abandoned from exhaustion of capital, or which have become economic through improvements in technology or appreciation in markets are now, under the stimulus of increased State or private "risk" money being widely undertaken.

This week we have to notice successes which have been achieved in gold mining in Colorado and in Western Australia which may well stimulate hopes of restoring interest in the search for that present Cinderella of metals—gold. Our Australian correspondent has referred to the improvement in the prospects of the Kalgoorlie and Mount Magnet fields where the initial interpretation of the geological theory that orebodies previously worked were intimately connected with the drag folding of the geological structure of the areas. In Colorado the last issue of the Denver *Mining Record* to hand records that Cripple Creek camp has been buzzing with excitement over two "Aladdin's Caves of gold" which have been disclosed in the bottom level of the Ajax mine on Battle Mountain, at a depth of some 3,100 ft. Cripple Creek shares with the Kalgoorlie field the distinction of holding the only deposits of telluride gold of economic importance. Whether this coincidence has any bearing on recent discoveries we have no means of knowing, but the Bonanza in the Ajax mine moved the mine superintendent to remark that he had never seen anything like it though he had worked in the camp since 1914. The big stope in the mine extending from the 31st upwards to the 26th level appears to have been yielding high-grade ore for some little time past, but the "Jeweller's shop" was disclosed in two vugs, the larger of which is described as 4 ft. across and 20 ft. long, which, when blasted into, revealed stalactites hanging from the quartz walls and looking like $20 gold pieces—at a guess, $50,000 worth of gold in sight. The last time any similar vug was revealed in Cripple Creek was in 1914 at the Crescent mine from which vug it is said that $1,200,000 was cleaned up and it is thought that the present discovery may equal that. Officials of the Golden Cycle Corporation which owns the Ajax mine are reported to have estimated that the better ore may run from $40 to $50 per lb., say £28,000 to £30,000 per s.ton.

Even allowing for the exaggeration natural when such an outstanding discovery is made, and the fact that definite assays and tonnage computation are still lacking the discovery is one which is bound to rekindle hopes of a resurgence of interest in gold mining.

Four Decades of Accident Prevention on the Witwatersrand

From Our South African Correspondent

The Witwatersrand goldfields offer a striking study of underground safety engineering practice, for here all safety effort is reduced to the simplest of terms owing to the illiteracy of the native labour force. The following article records the remarkable results achieved by the Prevention of Accidents Committee of the Transvaal Chamber of Mines and notes several of the peculiar difficulties which have been surmounted in achieving the safety record enjoyed by the area.

This year marks four decades of the activities of the Prevention of Accidents Committee of the Transvaal Chamber of Mines. Over this period the mines have been made twice as safe to work in as they were 40 years ago and, moreover, everyone working in them has been instructed in safety measures. To mark the occasion a considerable amount of material has been published dealing with varying aspects of safety, covering the historical background, present methods and some suggestions as to what lines are likely to be pursued in the future to reduce the accident rate still further.

The basis of safety in the mining industry is laid down by Statute in the Mines and Works Act which was originally passed in 1911, but which has been steadily brought up to date in the light of changing conditions and increased knowledge. Valuable as this Act is, its measures must naturally be rather of a negative nature, laying down penalties for sins of omission and commission. The Prevention of Accidents Committee's work is essentially positive. Its guiding axiom is that accidents do not just happen, but that each arises from a definite cause and most can be prevented.

AN ILLITERATE LABOUR FORCE

The great problem facing the organization is instilling in some degree safety-mindedness in the more than 300,000 African workers of the gold, diamond, base mineral mines and collieries. They come from all over Southern and Central Africa. Of them, only two per cent live permanently on the mines. As a general rule, the rest work some seven or eight periods of about 14 months each. Much that they learn about safety is forgotten during their periods of rest, and refresher courses are needed when they return to the mines. To make the work even more difficult, less than five per cent of these workers are literate and, even if they could read, literature would have to be put out in 41 languages and dialects.

One of the most successful methods found so far is the coloured poster. These show in simple but striking fashion the risks of careless working. For example, an ore truck out of control through carelessness is compared with a large elephant charging a native warrior, and a charge of explosive that has misfired is likened to a cobra with its hood extended and poised to strike.

Films are another powerful propaganda weapon. The Chamber of Mines has a cinema circuit to entertain native mineworkers, and over the past 11 years these free shows have included among the Wild Western dramas and slapstick comedies, so popular among the workers, safety films produced by the Prevention of Accident Committee. These are in colour and the commentary is in "Fanakalo," the *lingua franca* of the mining industry. Films are not being limited to purely mining safety. One has been completed dealing with safety on railway journeys and another is in production on road safety. About 500,000 workers see the free shows a month.

A most important safety weapon is the inter-mine safety competitions which involve close co-operation between both European and African workers. It is divided into various groups and is broadly based on the lowest fatality rates and the greatest measure of improvement. In addition, first aid competitions are held. First aid training is encouraged among all mineworkers. Natives are keen on it, and the training given them is of growing importance to the country generally, as increasing numbers are going home with knowledge of first aid and simple hygiene.

EMPHASIS ON THE PERSONAL FACTOR

Only about 15 per cent of accidents in all industry are caused by mechanical factors. In the South African mines accidents from this source have been steadily reduced over the years and seem to be approaching the absolute minimum. It is the reduction of the number due to the personal factor that is now engaging increasing attention. Dr. R. A. Mathews, the Medical Officer of the Social Services Department of the Transvaal Chamber of Mines, has prepared a paper on some aspects of this. He points out that the personal factors can be broken down into three headings—physical conditions, working environment, and mental conditions. Dealing with physical condition he advocates proper physical evaluation of employees and careful job analysis, which combined can produce not only increased efficiency but bring about a lower accident rate. Fatigue plays an important part in accident proneness. Bad ventilation, poor lighting and the like, a worrying supervisor and boredom all contribute to fatigue.

So far as working environment is concerned, efficiency and liability to accidents are closely related. An important factor in this which is being closely studied is the provision of adequate nutritional needs. Information obtained from an investigation at Iscor—the South African steelworks which operates on a three-shift basis over 24 hours—shows that contrary to popular opinion the night shift showed the lowest accident rate, while the peak was between 9 a.m. and midday. After careful elimination it was discovered that the feeding habits of morning shift workers were at fault and caused the onset of fatigue towards end of shift.

Mental factors affecting accident rates are: poor morale, insufficient skill and psychoneurosis. In the first group, the aim must be to make workers happy and contented in their jobs, and good progress is being made in this direction by the appointment of personnel officers.

A large group of workers sustain accidents due to lack of knowledge or skill, particularly new employees. To overcome this increasing attention is being given to training. Particularly good results are being obtained on a number of mines, which is resulting in lower accident rates, fewer lost shifts and increased general efficiency.

From the purely psychological angle, it is suggested that accident prone workers should be submitted to a psychological examination where possible and, in addition, attempts should be made to adjust their social background.

Summing up, Dr. Mathews takes the view that when medical science has been in industry, and in every factory or works in industry, as long as have industrial engineers and safety officers, and has had the freedom of action and co-operation of executive officers which they enjoy, then industry will see a drastic cut in the 80 per cent of accidents due to human factors.

How Long Will Our Existing Mineral and Fuel Resources Last

In these hurried days, the Annual Meetings of the British Association provide one of the very few opportunities for our scientists to put aside the problems of the immediate present and in this momentary leisure, to think, both aloud and publicly, much further ahead than is possible in an age where pure science so often seems to be taking second place to the application of principle to practice. At this year's Liverpool meeting of the Association particular interest to the mining industry attaches to Lord Dudley Gordon's presidential address to the Engineering Section on "Engineering in the next two thousand years." The challenge for the future, which he threw out to his audience, lay in the solution of two inter-related problems, namely the continued provision of sufficient power to meet world demands and the supply of materials not only to generate this power but equally to feed the manufacturing and constructional processes through which power could benefit mankind. In his view the critical question they had to consider was how long would the earth's fuel and mineral resources last out. He developed his argument along the following lines.

Aside from wind and water power, the energy, from which power has been derived, has, until quite recently, been created by the combustion of wood, coal or oil. In the early industrial era no conservation problem was foreseen, but thinking in recent years, with the Paley Report as the most recent example, has emphasized that mineral resources are not inexhaustable. And indeed, as the Paley Report has made clear, looking no further ahead than 25 years proves to be a very uncertain exercise. This uncertainty becomes all the greater when it is recalled that at present some ten per cent of the world's population is consuming half the volume of materials now being produced from the earth's surface. Implicit in Lord Dudley Gordon's comment is, of course, the vast potential expansion in demand as the standard of living in the underdeveloped areas of the world rises, and while, as he points out, many less accessible mineral deposits have yet to be worked, these are bound to be at a higher real cost.

FUEL RESERVES

Reserves of coal vary widely from country to country with, perhaps, 250 years reserves in the United Kingdom against 2,500 years in the U.S.A. Oil may well become exhausted within a generation although, unlike coal, new deposits are constantly being discovered so that the point of exhaustion is coming no nearer. Moreover, estimates probably ignore undersea deposits. Other fuels, such as natural gas, peat and oil shale will not make any considerable contribution to world sources of heat in the long term.

So much thought is given to-day, alike by the scientist and general public, to the development of nuclear energy that less anxiety exists about the question of fuel supplies than would have otherwise been the case, but here again the problem of the availability of fissionable material arises. At present the development of nuclear energy depends on the availability of uranium, and possibly thorium, which come from resources which, at the present rate of consumption may well be exhausted within 2,000 years. There is, however, the possibility that by a process of reaction, there may be a type of reproduction, the so-called "breeder piles" (the existence of which has recently been announced in the United States), which would greatly reduce the amount of uranium required and so extend the life of discoverable resources.

Nor is it impossible that some alternative method of producing nuclear energy may be found. The development of the hydrogen bomb suggests the possibility that the almost unlimited amount of hydrogen recoverable either from the air or the sea may be used as a fuel in the form of heavy hydrogen.

OTHER SOURCES OF POWER

Sources of power which do not depend on heat production are water power, the wind and the tides. Of these the wind is too variable for use as a constant source of power and solar energy seems to be subject to similar limitations. In any event, the generation of electricity from these sources can only be undertaken where nature makes them readily available, and consequently implies dependence on the costly transmission of power over great distances. Moreover, generation from intermittent sources of energy cannot be fully utilized until the means have been found for large-scale storage of electricity.

There may be other sources of power as yet un-explored. Gravitation may one day be used in such a way that its intensity and direction can be controlled and varied at will to yield power in a direct form. Such power can have many uses, particularly for travel.

HOW LONG WILL MATERIAL RESOURCES LAST

All sources of power, however, are dependent for their application on machines or apparatus constructed from materials obtained from the earth's surface. Thus we come back to the questions of how long existing resources of fuel and minerals are likely to last as demands increase, and what will eventually take their place. The general indication is that iron and steel products will continue to be the main sources of supply, certainly for the next few hundred years, and there is still great scope for development in the production of iron and steel in the direction of improved composition and structure of metals so that the same results can be achieved with a much smaller weight of materials.

Hitherto sources of fuel and minerals have been sought almost entirely from dry land but the ocean may well prove to be the earth's greatest storehouse of minerals. Two important materials are already obtained in large quantities from the sea—magnesium and iodine. In the case of magnesium, it is estimated that 4,000,000 tons are normally present in each cubic mile of sea water.

Unlike mineral resources, which at least within measurable time are irreplaceable, agriculture and forestry have shown how both vegetable and meat supplies can be increased, although whether fast enough to keep pace with population trends remains to be seen. Here the solution must be with irrigation and consequently a great development of civil engineering and of forestation.

It seems reasonable to assume that we have reached the stage in the development of scientific knowledge which could form a basis for future advance with a diminishing reliance on the principle of trial and error. The present generation can therefore feel that it has not merely a great opportunity but a great responsibility to begin now to develop methods which would make it possible for the progress of man to continue when the resources at present available have become exhausted.

"Failure to commence development on these lines within the next 50 or 100 years," Lord Dudley Gordon suggests, "would mean that life on this planet within 2,000 years might well deteriorate to a level much lower than that existing to-day."

A Review of Chromite Resources—I

The world resources of chromite are reviewed in an article, of which this is the first part, dealing with the characteristics and uses of the ore and its general statistical placing. The position of the Union of South Africa as the world's principal source of supply is also discussed here, while the standing of the other main producers—notably Southern Rhodesia, the U.S.S.R. and Turkey—will be considered in a later issue. The evidence suggests that in the long term chromite producers have no reason to fear the consequences of expanding production.

Between 1920 and 1950 the annual world output of chromite rose from 238,560 tonnes to 2,300,000 tonnes. The United States consumed one half of all the chromium ores produced in the world during the past 50 years and 55 per cent of those produced in the past decade. From 672,773 s.tons in 1949, U.S. consumption soared to 980,369 s.tons in 1950 and 1,215,386 s.tons in 1951.

Four countries between them have contributed the bulk of the world's chromite supplies. From 1906 to 1950 inclusive Southern Rhodesia produced 18.6 per cent of the world total, the U.S.S.R. 15.3 per cent, the Union of South Africa 12.4 per cent, and Turkey 11.4 per cent. In the same period only 1.6 of the total world supply was produced in the U.S. Since its reserves of domestic ore directly usable by present practice are extremely limited, it seems evident that the U.S. will be critically dependent on imported ores for the requirements of future expansion. The authors of Paley Report forecast that by 1975 the U.S. demand for chromite will have risen to about double the 1950 figure.

World production of chromite rose to a wartime peak of 2,031,000 s.tons in 1940, falling progressively to 1,100,000 s.tons in 1945. The tide then turned again and in the next five years output more than doubled, reaching 2,300,000 s.tons in 1950. With past vicissitudes still quite a recent memory, some uneasiness may be felt as to the capacity of world markets, under more normal conditions, to support indefinitely the high levels of production now prevailing. If authoritative estimates of future consumption are correct, however, the overall picture over a period seems more likely to be one of scarcity than of over-supply. Existing reserves are placed at some 300,000,000 tons of contained Cr_2O_3, of which 20 per cent or less are of the higher grades required for metallurgical and refractory purposes.

CHARACTERISTICS AND USES

Chromite is the only commercial source of chromium, which is among the most important strategically of all metals, being an essential ingredient of all stainless steels and of other high temperature alloys used in the production of jet aircraft and gas turbines. For metallurgical use the ores are usually smelted in electric furnaces to produce ferrochromium, which contains 65-72 per cent chromium, a maximum of 2 per cent silicon, and the remainder iron. Metallurgical grade ore for ferrochrome production should contain a minimum of 48 per cent chromic oxide, with a chromium-to-iron ratio of not less than 3 to 1. A hard, lumpy structure ½ in. to 6 in. in size is preferred. Silica is undesirable and combined magnesia and alumina of more than 25 per cent may be objectionable. About half the output of chromite is used to produce chromium for alloying or metallurgical purposes.

In the chemical industry chromium and its compounds have a variety of important applications. Sodium bichromate is the primary chemical from which other chromium compounds are produced for use in pigments, tanning, plating, dyes, etc. Chromium salts also serve as inhibitors of corrosion when added to aqueous media. In plating chromium, use is made of the oxide, Cr_2O_3. About 15 per cent of the chromite production is used in the chemical industry, including electroplating. Chemical grade chromite should contain a minimum of 45 per cent of chromic oxide, and within limits a high iron content is not harmful.

Chromite itself is a neutral refractory, which is highly resistant to both acid and basic slags. It is, therefore, used as a furnace lining for areas intermediate between the basic hearth and the acid, this field of applications accounting for about 35 per cent of the total chromite production. Refractory grade chromite contains 63 per cent of combined chromic oxide and alumina, with 57 per cent a common minimum. Typical ores contain about 34 per cent of chromic oxide. The iron and silica contents should be low.

SOUTHERN AFRICA THE MAIN SOURCE

The Union of South Africa and Southern Rhodesia combined are believed to have about 80 per cent of the world lode chromite reserves. Parks, in *Mining Engineering* of May, 1952, credits the Union with reserves of 50,000,000 tons and Southern Rhodesia with 50,000,000 tons, but it is possible that both estimates are unduly conservative.

Thus, a few years ago, Dr. Kupferburger, Superintendent of Mines of the African Metal Corporation—whose products include ferro-chrome—stated that the Union of South Africa possessed probably the world's largest known reserves of chrome ores, amounting to more than 1,000,000,000 tons, if all minor seams were taken into account. Last year South African producers sold 458,785 tons of chromite for the record total of £1,683,182. But for reduced truck allocations these figures would have been appreciably better, for production was again restricted by inadequate facilities for rail transport, and stockpiles reached their largest proportions during the year.

American industrialists and metallurgists, who have recently been investigating the Union's chrome ore resources, expressed the opinion that a great future awaits this industry. They pointed out that the United States was almost entirely dependent on the Transvaal for supplies of chemical grade chrome, and that the known deposits were estimated to contain sufficient reserves to meet world requirements of this grade for the next 200 years. South African producers fear, however, that if the existing transport difficulties are perpetuated, the Union's chrome industry might lose its present leading position in the world chemical chrome trade, as consumers are continually being forced to look elsewhere for their requirements. Loans by the International Bank are helping to overcome the shortages of power and rolling stock.

The chrome ore of the Transvaal Bushveld does not consist purely of the oxides of chromium and iron, but also shows the oxides which enter into spinel. It has, therefore, been described as chromitite rather than chromite. For industrial purposes the chromitite is classified as *friable* and *hard lumpy*. Most of the Bushveld ore is of the friable variety. In the mine this ore is very tough, but it pulverises with blasting and handling and crumbles when exposed to air.

It is considered that in all probability a large percentage of the total Transvaal resources has a chromic oxide content of between 40 and 45 per cent. Grades containing up to 48 per cent Cr_2O_3 are also available. Although the Cr/Fe ratio averages only about 1.9 to 1, some layers in the Bushveld complex yield high-chromium ores that are readily blendable with standard metallurgical ores. Ore of the higher grade (43 per cent and over) is not present over the whole strike of the chromitite belt and in many instances is not sufficiently close to the railway to ensure a steady delivery and keep transport costs within bounds.

Hydraulic Transport of Solids

By W. DAVIES, Ph.D., B.Sc., A.M.I.Mech.E.

Although the efficiency of the hydraulic system of transporting solids does not compare with that of a direct mechanical system, such as a belt conveyor, elevator or balanced rope hoist, it has considerable advantages in the non-ferrous and coal mining industries which may outweigh its disadvantages. For example, it might provide the ideal solution of some of the difficulties being encountered in the reorganization of the transport and hoisting systems in some of the older coal mines and there is undoubtedly a wide field of application for it in mechanized mining. The following article describes the fundamental principles governing the flow of mixtures of ores or coal and water through pipes—horizontally or vertically—as well as outlining the technical problems involved and the part played by pumps in the functioning of the system.

The action of flowing water on sands and gravels has been studied by mining engineers for many years, particularly in connection with alluvial mining and mineral dressing, and a certain amount of empirical knowledge of the conditions governing the flow of mixtures of water and solids in pipes has been gained in the application of hydraulic stowing in coal mines. This method of transporting solids is widely used in suction dredging and in some branches of civil engineering, but high pumping losses have hitherto militated against its success as an alternative to the conventional forms of transport where these can be applied. Renewed interest is being taken in this subject at the present time, however, and a hydraulic system has recently been installed in Lorraine to transport coal over a distance of 5¼ miles from a central washery to a power generating station. The pipe is 15 in. in diameter and is capable of transporting up to 6 tons of coal a minute in sizes below 3 mm. No information has been given about the power consumption of this system but it is claimed that the cost of transport, on a dry coal basis, is less than a penny per ton-mile, including capital and depreciation charges. A smaller plant of a similar kind has also been erected at Markham Colliery to transport coal up to 3 in. in size from the pithead to the washery over a distance of 1,000 ft., but a far more ambitious scheme is now being contemplated by the Ministry of Fuel and Power and the National Coal Board to pump coal at the rate of about a million tons a year from the Midlands to London.

Mining engineers are naturally interested in the possibility of using the hydraulic method as an alternative to hoisting in shafts. This feat has already been accomplished at a metal mine in Canada, where pieces of ore up to 4 in. in size have been pumped successfully to the surface through a 10 in. diameter pipe. Calculations made by R. C. Worster,[1] based on the limited data available at present, show that an input of 430 h.p. would be required to pump 100 tons of coal an hour through a height of 1,000 ft. in a 10 in. pipe, assuming the average size of the coal to be 3 in. The rate at which useful work would be done in this case would correspond to 113 h.p. and the "hoisting" efficiency would thus be 26 per cent compared with, say, 65 per cent for a balanced A.C. winder.

WIDE APPLICATION IN MECHANIZED MINING

Losses due to turbulence and other causes are inevitable when solids are carried in a stream of water and it is very unlikely that the efficiency of any hydraulic system can ever approach that of a direct mechanical system, such as a belt conveyor, bucket elevator or a balanced rope hoist, but the hydraulic method could have many important advantages in mining which would probably outweigh its deficiency on an energy basis. It might, for example, provide the ideal solution for some of the difficulties which are being experienced in reorganizing the transport and hoisting systems in the older coal mines and there is undoubtedly a wide field of application for it in mechanized mining.

The scientific and technical problems of hydraulic transport are being investigated in Great Britain by the British Hydromechanics Research Association at Harlow, by Le Laboratoire Dauphinois d'Hydraulique in France and by various research establishments and universities in the U.S.A. and the U.S.S.R. The Ministry of Fuel and Power and the National Coal Board are also taking an active interest in the development of this mode of transport and much of the work is sponsored by them.

EFFECT OF VELOCITY AND PARTICLE SIZE

The velocity of the mixture in the pipe and the average size of the solid particles are two of the most important factors governing the cost of hydraulic transport. A high velocity is obviously desirable to safeguard the system against accidental clogging of the pipes, but, on the other hand, it is detrimental to economy in power consumption because the loss of head due to pipe friction increases approximately as the square of the velocity. The optimum rate of pumping must therefore be based on a judicious compromise between these two conflicting requirements. In the transport of solids in a finely divided state the average size of the particles has a very marked effect on the power consumption. It is relatively high for very fine particles and it decreases with increase in particle size up to about 50 microns after which it increases again to a limiting value which appears to be independent of size for particles measuring more than 2 mm. Durand[2] states that in the transportation of coal at a concentration of 450 gm. per litre of water the loss of head due to pipe friction may vary from 1 to 20 according to the average size of the particles. In the transportation of ore by this method it would therefore be desirable to reduce the ore to about 50 microns, or 0.05 mm., before it is fed into the pipeline but in the case of coal, the size would be dictated by other considerations.

Particles less than 30 microns in size settle so slowly that it is easy to maintain a homogeneous mixture in the pipe at ordinary rates of flow and the conditions of flow are then similar to those for clear liquids. Fine ash, highly pulverized coal and fine clays and silt will form such mixtures and the economical point of operation will be in the neighbourhood of the critical Reynolds number, which, of course, will be influenced by any effect which the solids may have on the viscocity of the mixture. Particles over 50 microns in size will not form homogeneous mixtures at economical rates of pumping and the mode of transport will then depend on the dimensions of the particles. Up to 0.2 mm., the particles will mostly travel along in suspension, between 0.2mm. and 2mm. they travel partly in suspension and partly in a series of hops. Above 2 mm. most of the particles move only in a succession of jumps. It is an advantage, from an economical standpoint, to work with high concentrations of solids and at the lowest speeds consistent with the requirements of safety from accidental clogging of the pipe. Durand recommends a concentration of about 6.5 lb. of crushed coal per gallon of water for transportation along a horizontal pipe and most of the experiments that have been carried out so far seem to indicate that a pipe will transmit solids up to a third of its diameter without serious risk of blockage

The experiments carried out by the British Hydromechanics Research Association have shown that there are fewer difficulties in transporting solids by water vertically than horizontally. As in the case of horizontal transport,

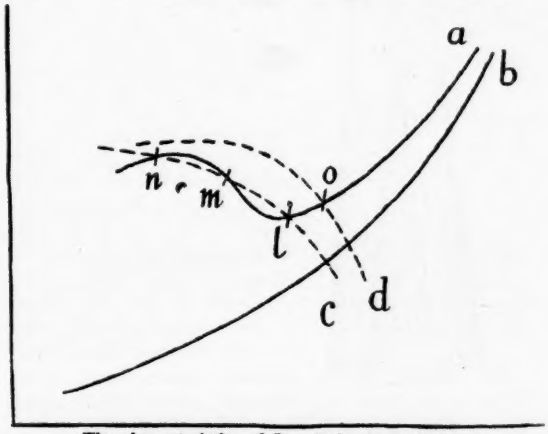
the optimum rate of pumping is arrived at by a compromise between the necessity of keeping the solids from piling up at the base of the column and the economic need for keeping down the power losses due to friction and turbulence. In calculating the h.p. required to lift 100 tons of coal an hour through a vertical height of 1,000 ft., in the example quoted above, Worster assumed a nominal pipe velocity of 4.5 ft. per sec. and an actual water velocity of 5.2 ft. per sec., which are not very different from the normal velocities in the rising mains of existing mine drainage installations.

THE CHARACTERISTICS OF PUMPS

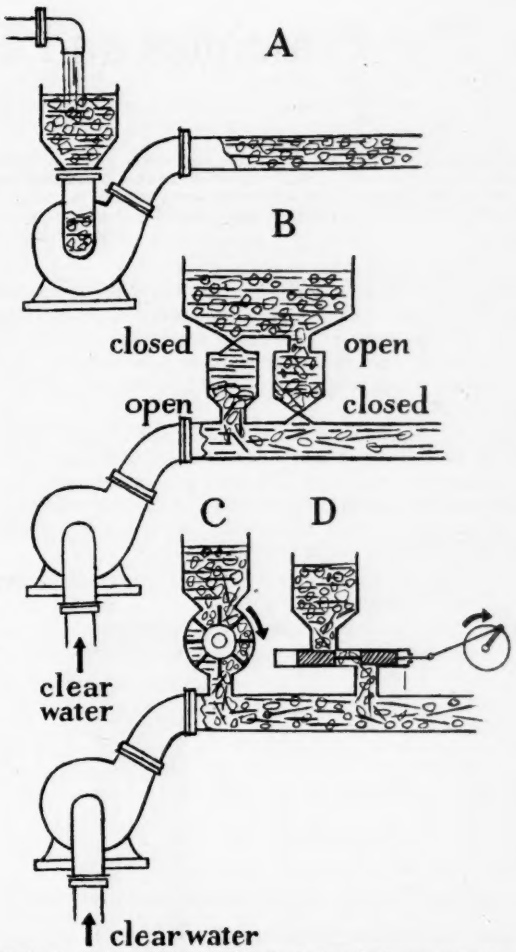
Reciprocating pumps have been used successfully to transport finely divided solids but in the event of an accidental blockage with this type of pump serious damage might be caused to the pipe and to the pump itself. The centrifugal pump has many obvious advantages for this kind of work but special care must be taken when selecting the pump to see that its characteristics are suitable for the conditions under which it is required to operate, otherwise serious trouble may be caused through instability. The relationship between the loss of head and the rate of flow of a mixture of water and solids is shown by the curve (a) illustrated below. This differs markedly from the curve (b) for clear water at low rates of flow but as the rate of flow increases the two curves tend to converge. The work done by the British Hydromechanics Research Association has been largely concerned with the study of the conditions which give rise to characteristic curves such as (a) for water and solid mixtures and considerable progress has been made by Prosser and Worster[3] in establishing rational methods for the analysis of these problems on a quantitative basis. The wide differences between curves (a) and (b) at low rates of flow can be explained in general terms by the fact that the pipe is merely obstructed by the solids until they gather sufficient momentum to move with the water, or, as Worster puts it, until the solids become fluidised.

The importance of the curve (a) will be readily understood when it is considered in relation to the pump characteristic curves such as those shown by the dotted lines (c) and (d). A pump having the characteristic (c) would obviously be unsuitable for the conditions represented by (a) since it intersects this curve at three points, l, m and n, and any one of these could therefore be an operating point and the pump would be unstable in the region between them. A pump with the characteristic (d), on the other hand, could have only one operating point (o) and it would remain stable at this point. These curves show that, in general, a centrifugal pump for this work should have a sharply drooping characteristic which intersects the pipe characteristic as nearly as possible at right angles.

The usual methods of getting the solids into the pipe for



The characteristics of flow in horizontal pipes



Methods of introducing solids in hydraulic transport schemes

hydraulic transport are shown diagramatically above. In the simplest method shown at (a), the solids are fed directly into the pump section. This method is widely used in mineral dressing and other plants but it is suitable only for relatively small particles and for fairly low pumping heads, and even then, only when the efficiency of transmission on an energy basis is not of great importance. Method (b), which has been used successfully for pumping metallic ores through shaft columns in the Canadian experiment referred to before, consists of two pressure tanks which can be put into communication alternatively with the hopper above the pipe on the delivery side of the pump. The rotary mechanical feeder (c) is of the type commonly used in pneumatic stowing machines and the reciprocating feeder (d) has been developed by the British Hydromechanics Research Association for feeding coal into their experimental transport systems at Harlow. It can be made double acting by extending the ram and using two slots instead of one to register in turn with two ports leading to the pipe. An obvious objection to this mechanism is that the solids are liable to be caught between the edges of the ports and the ram.

REFERENCES

1. R. C. Worster (British Hydromechanics Research Association), Reports to National Coal Board Colloquium on the Hydraulic Transport of Solids. November, 1952.
2. R. Durand (Laboratoire Dauphinois d'Hydraulique), ditto.
3. L. E. Prosser (Director, British Hydromechanics Research Laboratories, Harlow) and R. C. Worster, The Hydromechanics of Fluid Flow. Arnold, 1951.

The Principles and Practice of Roof Bolting

By A. GRIERSON, B.Sc., A.M.I.Min.E.

Roof bolting in the U.S.A. has made very rapid progress within the last five years. Its original application and subsequent widespread use as a system of roof support was chiefly in coal mines and the metal mining engineer tended to regard it as being on the periphery of his interests. The fact that it has now been successfully used in metal mines in various parts of the world has brought it well within his scope. Thus the following article, outlining the basic principles of roof bolting, the types of bolts used under varying conditions, and the kind of equipment required.

Although it is only within the last five years or so that roof bolting has become fairly widespread in application, reinforcement of strata by means of rods was propounded by Z. S. Beyl, a Dutch mining engineer, as long ago as 1912 and isolated installations have existed in the U.S.A. since before 1914.

Roof bolting is a system of support which broadly speaking can be said to induce rigidity in strata with the aim of preventing rock breakage. The manner in which roof bolts achieve the desired end depends on the nature of the strata in which they are used, and installations can for convenience be classified in either of two ways :

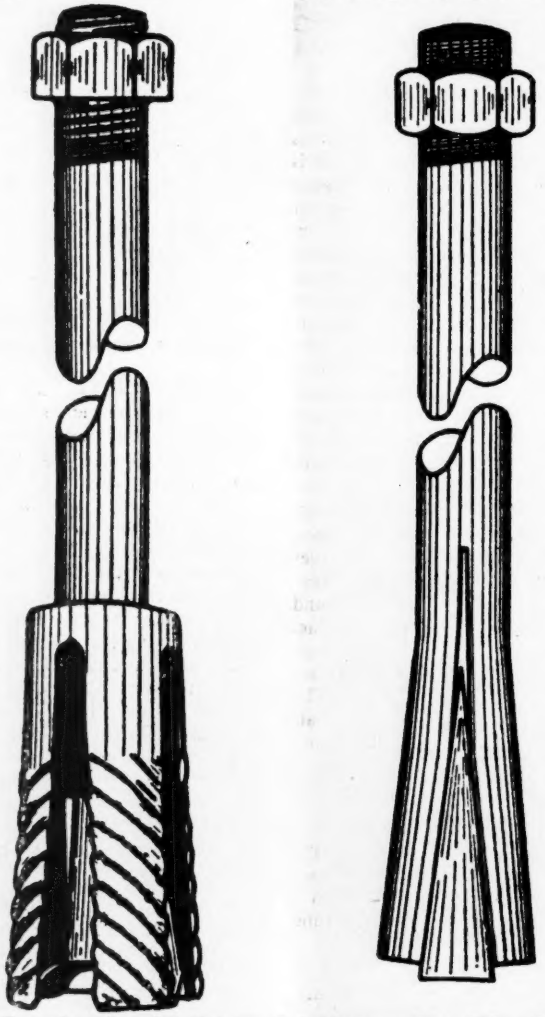
(1) Those in which the bolt attaches the immediate roof to a stronger stratum above,

(2) Those in which the principal aim of the bolt is to bind several thin layers of strata thus giving the effect of a single multiply stratum.

In the first instance the immediate roof is suspended from a strong self-supporting bed and thus the rods or roof bolts are subject to tensile stress. They serve the same purpose as props but function in reverse in that the action is one of suspension from above rather than support from beneath.

Where the roof bolts are inserted to bind together several individually weak layers their usefulness is apparent from consideration of the basic engineering principle that deflection of a beam is inversely proportional to the square of its depth. That is to say that if a roof be regarded as a rectangular beam under load and consists of ten separate layers each of unit strength, when bolted together to form in effect a compound beam, these layers would have a strength equivalent to 100 units. Any subsequent deflection of such a compound stratum would induce shear stress in the bolts.

In general practice the steel rods or roof bolts are $\frac{7}{8}$ in. to 1 in. diameter and the length 2 ft. to 9 ft. according to the characteristics of the rocks and the thickness of the beds to be reinforced. The bolts are inserted into holes drilled in the roof, usually normal to the plane of the strata. The insertion of rods at different angles has on occasions given better results and the best position for the bolts should be determined by experiment.



Examples of roof bolt types. Left, the expanding shell and right, the split wedge type

TYPES OF BOLTS

Basically there are three main types of roof bolts each type consisting essentially of a steel rod, a device for anchoring the rod in the hole, and a threaded end to support a bearing plate. As will be seen the essential difference lies in the manner of anchoring the rod in the hole.

Split end wedge bolt:—This is the simplest type available and consequently is the most widely used. It has the advantage of being easily made in most mine workshops. It consists of 1 in. diameter mild steel rod equal in length to the depth of the hole in which it is to be used plus 2 or 3 in. A slot $\frac{1}{8}$ in. thick and about 6 in. long is cut in the top of the rod and the bottom 6 in. are threaded to take a retaining nut. This nut is used to secure a small bearing plate against the bottom of the hole. If the roof is fragile or has been broken prior to the insertion of the bolts, bars are suspended between adjacent rods, by means of these bolts.

The wedge used for anchoring the rod in the hole is of mild steel and is $\frac{1}{2}$ in. less than the length of the slot, tapering down from $\frac{1}{2}$ in. square at the upper end to $\frac{1}{2}$ in. x 1/6th in. at the lower end. The dimensions quoted are from an actual installation and can of course be modified to suit requirements. To instal a split end wedge bolt the wedge is placed in the slotted end of the bolt and the unit inserted in the hole until the wedge comes in contact with the roof. A sharp tap is then given to the projecting end of the rod which expands the slotted portion of the bolt sufficiently to retain it in the hole temporarily. The projecting end of the bolt is then hammered home by a pneumatic hammer or other means. The threads are protected from damage by the retaining nut which is

finally tightened up on to the bearing plate. This tightening is best effected by a bolt tightening adaption on the drill or an impact wrench. The split end type of bolt requires that the depth of the hole drilled be closely controlled, for the rod will not seat correctly if the hole be too long and will protrude too far if the hole is too shallow. Excessive tightening of the bearing plate retaining nut will not dislodge the rod but will damage the thread. The split end roof bolt is shown on page 298. In practice it has been found that failure of the rod at the weakened split occurs and a modified design giving greater strength has a slotted shoulder piece.

Expanding shell bolt:—There are several types of such roof bolts each employing the principle of anchoring the rod in the hole by means of an expanding shell. A typical

A roof bolted roadway at Reedley Colliery, Yorkshire

expanding shell bolt is illustrated on page 298 and consists of a 0.75 in. diameter rod the bottom end of which is threaded for some 3 or 4 in. The upper end of the rod is widened out to 1 in. diameter, this fitting into an expansion shell having four serrated arms pointing upwards. To anchor the roof bolt in the hole the rod is placed inside a 1 in. diameter pipe some 18 in. longer than the depth of the hole so that the widened head of the bolt is resting on the expansion shell which in turn is supported on the top of the 1 in. insertion pipe. Then the pipe is introduced into the hole with the expansion shell uppermost. Hammer blows on the blows on the lower end of the insertion pipe cause the square top of the roof bolt to be driven into the expanding shell, the arms of which are forced outwards and so tightly grip the sides of the hole. This effectively anchors the rod in the hole and the insertion pipe is then removed and the retaining nut tightened against the bearing plate.

Screwed expanding shell bolt:—This differs from the previous expanding shell type in that both ends of the rod are threaded. The shell consists of two wedges, the larger of which fits loosely over the bolt and is serrated to prevent downward travel. The smaller wedge is screwed and machined with vertical serrations to prevent it turning. When the bolt is tightened into the shell by means of an impact wrench the thrust is developed against the larger wedge which is retained at the top of the hole. The smaller wedge being prevented by the serrations from rotating travels down the inclined plane of the larger wedge and so grips the side of the hole and anchors the bolt.

TESTS ON ROOF BOLTS

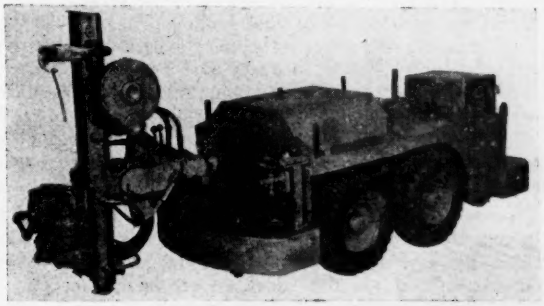
Whilst much depends on environmental conditions the following account of a series of tests carried out on roof bolts is worthy of note. All loads were applied through a lever with a velocity ratio of five by means of an hydraulic prop set on a load block calibrated to 0.05 tons.

A split end wedge bolt was inserted in a hole drilled in the roof and secured by applying pressure via an hydraulic prop. (This system of driving home roof bolts is too slow and cumbersome for normal day to day practice in the mine and is seldom employed. It has been found that a sustained force of 20 tons is required to set a 1 in. diameter wedge type bolt in shale.) A telescopic gauge reading to 0.01 in. was inserted between the bolt and the floor and incremental increases of load applied. With a load of one ton the vertical movement of the rod in the hole was 0.05 in. and this rate of lowering continued almost lineally until a displacement of 0.47 in. was recorded at a load of 6.7 tons. Thereafter the rate of lowering increased slightly and the rod finally fractured across the threads at a load of 10.72 tons. The total downward displacement of the roof bolt was observed to be 1.34 in., the final 0.5 in. lowering being rapid in relation to the load applied. An additional telescopic convergence gauge set between the roof and floor revealed that no movement of the roof had occurred throughout the test. A second similar test on an expanding shell type of roof bolt 0.75 in. diameter showed a downward movement in the hole of 1.5 in. with a load of 6.7 tons. Subsequent tests have revealed that roof bolts, if correctly set, can withstand loads of the order of 10 tons with very little movement.

EQUIPMENT REQUIRED FOR ROOF BOLTING

The most important item of roof bolting equipment is the drill. This may be rotary or percussive depending on the type of power available, the characteristics of the rock to be drilled and also the type of roof bolt to be used. In the United States coal mines where some 25,000,000 bolts are used annually, it is estimated that rotary drilling can be used economically in two thirds of the mines. When using rotary drilling machines, impact wrenches driven by the drill are available. These give mechanized power for tightening the rods in the hole and for tightening the nuts on the bolts. These wrenches facilitate the setting of roof bolts and by their use a bolt can be set in under two minutes.

Percussive drills are widely used where the strata is hard. These drills have the advantage of both reciprocating and rotary motion and attachments are available to enable any type of bolt to be secured quickly. This type of drill dispenses with the need for an impact wrench but is, of course, less efficient than the rotary drill. A special portable mine type compressor for use on the face has been utilized. The machine is equipped with two boom mounted stopers mounted in front of the chassis to give low operating height. Where height is available the booms may be mounted on top of the compressor housing. If compressed air is avail-



The Joy RBD-15 unit which bolts at 400 r.p.m.

able from mains a wagon mounted stoper may be employed. This is an extremely mobile machine and has attachments for an easily fitted dry dust collector.

Also being developed are instruments and equipment for rapid testing of the bolts and for close inspection of roof conditions. Accordingly an instrument called a Stratoscope has been developed by the Roof Control Section of the U.S. Bureau of Mines giving information of roof sag and cracks in the strata. It must be emphasized, however, that wherever roof bolting is contemplated this should first

be done on an experimental basis. In some instances the data thus obtained has shown that roadways stand better if supported by a reduced number of conventional supports assisted by a complement of roof bolts.

Roof bolting operations are usually carried out by a team of two or three men and such a team in normal conditions can set 80-90 bolts per shift. The pattern of the bolts in the roof is of course best found from practical experience but a typical system in a 15 ft. wide road is to have alternate rows of two and three bolts, the rows being set at 3 ft. intervals, giving a density of one roof bolt per 18 sq. ft. of exposed roof. Assuming the above rate of installation this corresponds to a roof area of 160 sq. yds. supported per shift, this comparing very favourably on a labour basis with the setting of conventional supports. Even more striking is the saving in steel resulting from the introduction of roof bolting, and indeed it was the steel shortage which stimulated the introduction of roof bolts in British mines.

From the all important safety aspect, statistics show that the use of roof bolts is reflected in a lower accident frequency. Regarding costs it is impossible to generalize when comparing the relative costs of conventional support and roof bolting as there are too many widely varying factors involved. Apart from the bald installation costs one must consider the subsequent effects as indicated by accident rate, productivity, repair work, etc. Frequently these long term developments by far outweigh any initial considerations. In general the advantages of roof bolting may be briefly itemized as follows:

(1) The cross section of the roadways is free of props and bars thus facilitating the movement of men, machines and air;
(2) Improved roof control results as rock movement is at a minimum;
(3) Considerable economy of supports, support-men, and storing space;
(4) The roof may be supported right up to the face and the supports are secure from possible damage by blasting.

Roof bolting is of course eminently suitable for the highly mechanized room and pillar workings in the North American coal mines as the absence of conventional supports allows greatly increased manoeuvreability of the machines developed for use with this system of working. This is reflected in greater output and mine operators have found the introduction of roof bolting to lead to 20 per cent greater productivity in certain instances. Although rooms of up to 30 yds. in width have been worked using roof bolts, it is felt that roof bolting finds its best application in roadways rather than longwall faces. However, if solid stowing of the waste be resorted to, roof bolting on longwall faces offers possibilities.

Roof bolting has been tried on an experimental basis in a number of countries and in different types of mines. Although the original tests by Beyl in Britain were made some ten years ago, the experiments did not arouse much enthusiasm and it is only since the resounding success of roof bolting in the U.S. that interest has been fully stimulated and the potentialities of this system of support in certain conditions fully recognized. The iron mines of Giraumont in Lorraine have several thousand roof bolts in operation in a roof consisting of some 8 in. of limestone overlain by 2 ft. of soft marl and then further hard marl. The rods are 71 in. in length and are placed in the entries at 3 to 4 ft. centres. Also in France the potash mines of Alsace have been using roof bolting since 1949, while in the U.S. it is used in lead-zinc mines in Missouri and Colorado, and in iron mines around Lake Superior and in Alabama. Roof bolting is not then confined to coal mines but has application in any mine where bedded stata occurs.

REVIEWS

The Stock Exchange Official Year Book, 1953, Volume II—*Published by Thomas Skinner and Co. (Publishers) Ltd.*

Register of Defunct and other Companies, 1953.—*Published by Thomas Skinner and Co. (Publishers) Ltd. Price 30s. net. Price of the two annual volumes £7 net, by post, inland £7 3s. 6d., abroad £7 5s.*

Volume II of *The Stock Exchange Official Year Book* completes the 1953 edition of this standard work of reference to all securities quoted on the London and Associated Stock Exchanges. While Volume I contains all other groups of securities arranged under the same headings as appear in the London Daily Official List, the second volume contains the two largest groups of companies, namely Commercial, Industrial etc., and Mines. The volume contains in addition the index to both volumes.

Entries in the completed work exceed 26,000, including reference to many hundreds of controlled and subsidiary companies which are named in the notices of their parent companies. The second volume also summarizes the notices of the whole edition; nearly 10,000 London quoted securities are dealt with in the two volumes. The 1953 edition adds approximately 75 new notices of companies.

The Register of Defunct and Other Companies, which is published at the same time as the work already noted, contains information of the demise or reconstitution of securities and companies which have passed out of the previous editions of the Year Book.

Aluminium in Iron and Steel, *by S. L. Case and K. R. van Horn. Published for The Engineering Foundation by John Wiley and Sons, Inc., New York, and Chapman and Hall Ltd., London. Pp. 478 with illustrations and index. Price 68s.*

It may be that the role assumed by aluminium in modern ferrous metallurgy makes the appearance of this volume, the first of a new series, particularly timely. The first portion of the book contains a summary of data showing the favourable effect of small amounts of aluminium when added as a deoxidizer to molten steel, while the second part presents a correlation of data on the effect of aluminium as an alloying element in steel.

The monograph series of Alloys of Iron Research, of which this book is the first, is planned to provide metallurgists and engineers with concise but comprehensive summaries of available data, as reported in the technical literature of the world, on the effect of selected metals on carbon steel and on simple and complex alloy steels and cast irons. The volumes should provide a reliable foundation for further research.

In a Metal Merchants' Office, *edited by H. G. Cordero and L. H. Tarring. Published by Quin Press Ltd. Pp. 240. Price 21s. for standard cloth copy and 24s. 6d. for hard back. Both post free.*

This work has been edited and partly written by the editors indicated, who are joint editors of *The Metal Bulletin.*

Primarily intended to provide the rising generation of metal dealers with detailed information relating to the technique and knowledge necessary for trading in metals and ores, the work also holds considerable interest for experienced buyers and sellers in that it covers a wider range of subjects and commodities than are specialized in by one person under normal conditions.

The volume covers non-ferrous metals, ores, iron and steel and both ferrous and non-ferrous scrap, whilst a special chapter is devoted to the methods of operation of the London Metal Exchange.

MACHINERY AND EQUIPMENT

A Diesel-hydraulic Machine of Minimum Dimensions

Hitherto available to the home market only but now being offered to overseas buyers, the Muir-Hill LH-1 Loader is designed to offer the benefits of a mobile hydraulic bulk materials loader under the most confined working conditions. The manufacturers, Messrs. E. Boydell and Co. Ltd., have produced a unit weighing less than 2 tons which is stated to be capable of high rates of loading comparable with normal-size mobile loaders. This loading rate is achieved by an ease of control and general speedy manoeuvrability, which combine to offset the smaller size of the machine. The prime function of the unit is, however, the answer which its overall dimensions provide to situations where limitations of space—particularly headroom—have hitherto prevented the employment of any alternative to hand labour.

The Muir-Hill LH-1 Loader requires a minimum of 6 ft. 6in. headroom, has a wheelbase of 4 ft. ½ in., a track of 3 ft. 7 in. and a turning circle of 7 ft. 6 in. radius. These primary dimensions have the effect of enabling the unit to operate in approximately the same space as is needed by an individual labourer to work with a shovel. On the other hand, the Loader has a maximum under bucket clearance of 6 ft. 6 in. which enables it to load into hoppers, bunkers or skips, and all but the largest of road vehicles. The manoeuvrability of the machine springs in large part from the steering layout, which employs divided track rods which are actuated through a cam and roller box with lock to lock accomplished in 3½ turns.

During the past year the machine has been tested and adopted in the coke and coal industries as well as in the iron and steel trades, among other applications. In addition, it has opened new fields such as trimming bulk cargo between decks in ships' holds and in similar operations where confined space is a prior consideration.

The LH-1 is powered as standard by a 3-cylinder diesel engine of 2.36 litres capacity which develops 30 b.h.p. at 1,800 r.p.m. A 4-cylinder petrol engine is also available as an alternative. Power is transmitted through an 11 in. single plate dry clutch to a sliding mesh type gear box, giving two speeds in either direction. The driving axle is full floating and gives a final reduction of 10 : 1, while brakes of ample dimensions are provided on the driving wheels.

The beam and bucket are hydraulically operated, the former by twin single acting rams positioned on either side of the machine, and the latter by a single ram carried on the bucket head frame. The two actions are entirely independent, and full crowding action is afforded with partial or full discharge of the bucket at any height. Three alternative sizes of bucket are available; additional to the standard size of 10.5 cu. ft. capacity, a heavy duty bucket of 6.5 cu. ft. and a light materials bucket of 14.5 cu. ft. for coal and coke are supplied.

Initial Installation of Electric Trolley Locomotives in British Colliery

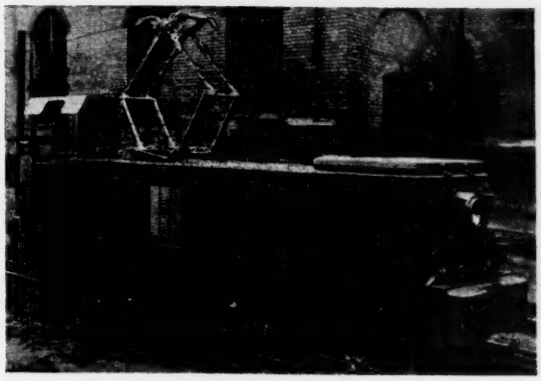
The first installation of electric trolley locomotives in a British coal mine for hauling tubs and man-riding vehicles has recently been put into commission by the North Western Division No. 1 Area (Sub-Area No. 2) of the N.C.B. at Sandhole Colliery. The Metropolitan-Vickers Electrical Co. Ltd., in collaboration with N.C.B. engineers, has supplied the locomotives, mercury-arc rectifier substation with associated switchgear, colour-light signalling, and power-operated point equipment.

The locomotives are running in roadways laid with double track, for a distance of approximately 1¼ miles, the average gradient being approximately 1 in 100 in favour of load. A single-contact wire overhead system has been supplied by the Liverpool Electric Cable Co. Ltd. for current collection; the track, which consists of 60 lb. rail, suitably bonded, provides the return path. The track gauge is 1 ft. 9½ in. The whole of the installation complies with Ministry of Fuel and Power regulations.

Four 8 ton locomotives, each having a rating of 62 h.p. at 225 V. D.C., have been provided. There are two force-ventilated traction motors on each locomotive, and filtered air for the ventilation is obtained from a separately mounted motor-driven fan. They are axle-hung with resilient bushed-link nose suspension, and drive the road wheels through straight spur gearing in the conventional manner.

The control equipment is of the remote electro-magnetic type with "dead man" feature. A single cab at one end of the locomotive contains all the driving controls, instrument desk and brake operating gear. Current collection from the overhead contact wire is by means of a specially designed pantograph having two independently sprung pans. A Westinghouse motor-driven compressor and air-brake equipment are fitted to each locomotive. The normal braking is by straight air with separate reservoirs for the emergency and "dead man's" brake applications. The necessary features to enable the locomotives to haul air-braked vehicles are also included, and the locomotive mechanical parts were manufactured by Messrs. E. E. Baguley Ltd.

The underground substation, which provides the power supply for the traction system, has an A.C. incoming supply at 2 kV. 3 phase 50 cycles, which is transformed down and rectified to 225 V. D.C. by a Metropolitan-Vickers 6-anode mercury-arc steel-tank rectifier rated at 120 kW. To ensure continuity of supply to the locomotives the rectifying equipment is duplicated, so that in the event of a fault occurring in one equipment, the other may be brought into immediate operation. The D.C. supply is connected to the system through high speed circuit breakers.



One of the 8-ton locomotives recently put into operation at Sandhole Colliery

In order to safeguard train movements and eliminate the necessity for men throwing the points in the tunnel by hand, thus reducing the possibilty of the men coming into contact with the live trolley wire, an electric power operated signalling system has been provided. This consists of 11 colour-light signals and 14 pairs of electro-pneumatic point operating mechanisms controlled from 4 small power interlocking frames, one at each junction and one at each end of the section. Communication between the signalmen is by telephone.

The locomotives haul trains of 70 tubs at speeds of up to 12 m.p.h. Initial stages of operation have proved that this traction speed is well within their capabilities.

A Magnetic Separator for the Mining Industry

A new type of magnetic separator for the mining industry has been developed by the Norwegian firm of A/S Thunes Mekaniske Vaerksted, in conjunction with a leading mining concern in the country.

Already in operation in various parts of Norway, the new separator is used for dressing and extracting iron ore, used in either the wet or dry system, for the removal of undesired iron from the other ores, and like material. The permanent magnet system is used and the equipment is independent of electric current. It is stated that iron ore concentrate leaves the separator containing over 70 per cent solids and can be sent directly to secondary mills and filters.

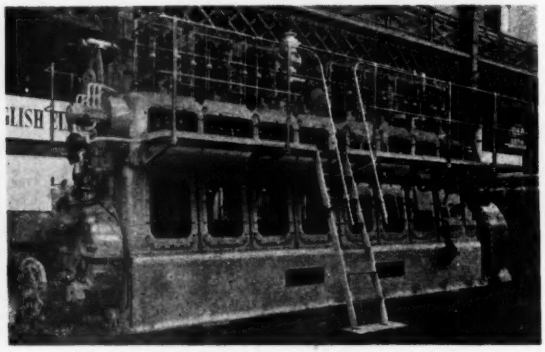
Motivation of Dual Fuel Engine by Methane Gas

An engine that will run on methane gas from a continuous supply in the underground seams at the Point of Ayre Colliery, North Wales, has been manufactured by the English Electric Company. The machine is now on display at the Marine and Welding Exhibition, Olympia, and is one of five being supplied by the company to the National Coal Board.

In addition to driving alternators, providing electricity for the entire Point of Ayre Colliery, the English Electric Type 8RLD Industrial Dual Fuel engine, with its four counterparts, will supply heat from the engine exhaust and the jacket cooling water for the pithead baths, central space heating, and for general domestic requirements. The machine weighs 58 tons, and is of 1,100 h.p. at 428 r.p.m. Its dimensions are length 23 ft., height 12 ft. and width over 6 ft.

Further news of the motivation power offered by methane gas is reported by the National Coal Board, which states that during August the Northern Gas Board's gas consumers at Whitehaven, Cumberland, began to receive a supply of gas recovered from the undersea workings at Haig Colliery.

For some time past the N.C.B. has collaborated with the Gas Council and the Northern and Wales Gas Boards to find out whether supplies of methane gas from coal mines could be made available for use by gas consumers. Methane has been the cause of many mine explosions in the past, and its quick removal from the mine ventilation air helps to ensure the safety



The Type 8RLD Industrial Dual Fuel Engine

of those working below ground. After much experimental work the Coal Board has evolved a system for collecting and piping the gas to the surface. Substantial quantities of methane gas will be delivered from Point of Ayre Colliery into a trunk main which the Wales Gas Board is constructing to link up a number of gasworks in North Wales.

There are sixteen collieries in various parts of the country at which methane drainage is being tried, and plans have already been made to drain at seven more. The quantities of methane are not likely to be great.

Wolfram Mining Methods in Thailand

In our issue of September 4, 1953, an article on the mineral resources of Thailand pointed out that the second largest metallic product of that country is tungsten. The deposits are confined to a belt of granite ranges on the border of Burma, with the most productive fields in the Pilok district.

Subsequent reports by the U.S. Bureau of Mines tell that the Pilok wolfram mines are open cuts wherein the placer method is used. Small tunnels are driven into the mountain sides for the purpose of prospecting only. Large quantities of overburden have to be removed and hydraulic mining is used wherever feasible. This practice necessitates the damming up of small ravines to secure an adequate supply of water, the construction of long ditches and flumes, and the occasional use of pumps to get the water up to the high ridges.

In the majority of mines the overburden is removed by hand methods and is transported to the sluice boxes in mine dump cars on light rail tracks or in man-carried baskets. The gravel passing through the sluice box retains some small pieces of ore, and this residue is panned in home-made wooden pans. Much of the tungsten is contained in quartz formations, although the quartz must be hand crushed by hammer before being deposited in the sluice box.

Nylon Driving Belts for Industrial Applications

Although the properties of nylon, particularly its great tensile strength and immunity to micro-biological attack, would apparently indicate it as satisfactory for the construction of power transmission belting, other characteristics present serious technical problems, notably its low friction coefficient and inherent elasticity. These are stated to have been solved in the manufacture of the new Gripoly nylon belt by Lewis and Tylor Ltd. To evolve a nylon belt of satisfactory standard took nearly eight years of experimental work.

The new belt consists of a nylon core with an interwoven cotton cover. Since nylon has a tensile strength three to six times as great as that of natural fibres it is possible to make the core considerably less in cross-sectional area than a normal belt, yet with greater strength. The cotton cover, which completely surrounds the nylon core, has a high natural frictional coefficient which is further improved by impregnation with a proofing compound. Thus cotton provides the belt's grip, and nylon its strength and endurance. Nylon is free from micro-biological attack, and in addition by concentrating the stress-bearing material of the belt on the natural axis of bending, great flexibility is achieved.

By pre-stressing the nylon and weaving the cotton with a high weaving angle, a freedom from all tensile stress is gained when the belt is in operation. The weaving angle of the cotton cover and the type of binder used overcome the low friction of nylon.

An Industrial Diesel Locomotive

To its range of small diesel locomotives built to quality standards of construction and to high specification the Hunslet Engine Co. Ltd. has added a 35 h.p. four-wheeler of 5 tons weight and 2.6 tons maximum axle load, built for narrow gauges from 600 mm. (1 ft. 11¾ in.) upwards. Powered by a Perkins P4 oil engine, set in this case to a top output of 35 b.h.p. at 1,700 r.p.m., the drive is taken through a Hunslet two-step gearbox giving track speeds of 3.85 and 7.7 m.p.h.

Top tractive effort in bottom gear step is 2,900 lb. and in top step 1,450 lb., the former giving an adhesion factor of 3.86 to 1. The 18 in. wheels are spread over a base of 3 ft. and length over buffer beams is 8 ft. 11 in. Loads up to 160 tons can be started and hauled in bottom gear, while curves of 25 ft. radius can be traversed, and lightest suitable rail is 15 lb. a yard. These locomotives are sold through Robert Hudson Ltd.

New Fireproof Belting Wins Approval

A new plastic fire resistant belting, named Leonex (green for safety) belting and intended for use in the mines of this country, is being produced at the Wellingborough plant of Rubber Improvement Ltd. for the National Coal Board. The company's plant is claimed to be the largest in the United Kingdom currently producing multiply plastic conveyor belting for underground use, has a capacity of 750,000 ft. per annum and was installed at a cost of nearly £250,000. The belting is the outcome of two years of research, and recently full scale production began after the approval of the N.C.B. had been obtained following extensive underground trials carried out by the Board.

The new belting was originally conceived and has since been pioneered by Mr. John Lewis, chairman and director of Rubber Improvement Ltd. His efforts have been made with the co-operation of the Central Research Establishment and the Field Investigation Group of the N.C.B.

Miners' leaders and N.C.B. officials are reported as agreed that inflammable rubber conveyor belting in pits should be replaced as soon as possible by that made from non-inflammable material. This attitude is emphasized by the realization that nearly 500 underground workers lost their lives last year.

At the termination of a tour of the works of Rubber Improvement Ltd., Sir William Lawther, president of the National Union of Mineworkers and secretary of the Miners' International Federation, gave his personal approval of Leonex belting.

METALS, MINERALS AND ALLOYS

COPPER.—The Chilean government is reported to be studying United States proposals regarding the acquisition of the Chilean copper stock, and Sr. Luis MacKenna of the Central Bank is believed to be on his way back to Washington with the Chilean answer. Meanwhile the government appears to be endeavouring to play off Russian advances against the United States proposals. While precise information is difficult to get it is reported that President Ibañez is reported to have signed a decree removing restrictions on trade with communist countries. The Chilean Foreign Minister is said to have denied reports of Russian negotiations to purchase, so far as his ministry is concerned. Originally the Russian trade mission in the Argentine was reported to have the matter in hand and advances by other avenues are possible. Meanwhile Chilean output at some 30,000 tons a month is going on and the stock must have increased since the earlier figure of 84,000 tons. When this stock is disposed of there is still the question of the disposal of future outputs. Nothing more has transpired regarding differences between the Northern Rhodesian copper companies and the African Mine Workers' Union. However, it has been announced from Ndola that a federal agreement giving preference to the Kafue Gorge scheme for the harnessing of hydro-electric power has been agreed on, leaving the Kariba scheme for future consideration. The Kafue scheme is much cheaper and may yield power in from five to seven years.

LEAD.—The lead market has continued to move in narrow limits in London and reports from the United States are of a moderate demand, with fair European buying of F.A.S. Gulf metal. However in the first six months of the year consumption totalled 595,865 s.tons against 531,002 s.tons in the same period last year. Improvement may be due to an increased demand from battery manufacturers (174,512 against 147,254). Consumption of tetraethyl lead also increased 77,382 s.tons against 70,916 s.tons. Though consumption for white lead dropped sharply there was a small increase in its use for pigments generally. Total stocks in July rose to 171,727 s.tons, the largest for a year. Domestic mine production in July was down at 26,531 s.tons against 28,472 s.tons a month earlier.

TIN.—There is nothing of outstanding importance in connection with tin this week. The most salient feature is the continued absence of any sign of a reduction in world output. Straits shipments in August according to the Straits Trading Company's statistics were 5,641 tons, the highest since March, bringing the seven months' total to 42,408 tons as against 42,460 tons in the same period in 1952 and 42,932 tons in 1951, a remarkably steady showing. Where the figures for the current year differ strikingly from those of a year ago is in the amount of tin shipped to the United States, which was 19,701 tons compared with 11,900 tons. Shipments to the U.K. were rather more than half, and Europe also took substantially less. These figures illustrate how much consumption now depends on demand from the United States, where consumer interest of late has been very dead with sellers unwilling to cut prices under the conviction that if they did it would not bring business. With autumn buying due to start any time now, the position there may improve. Mr. Ilgenfritz, vice-president of the United States Steel, remains "bearish" on tin: he recently expressed the opinion that expanding use of electrolytic tinplate will further reduce consumption, and that the law of supply and demand would increase its influence for some time to come. The strategic stockpile, he declared, still absorbed a goodly proportion of the over-production and this programme would reach its goal in the near future.

The complexity of the issues involved in any attempt to devise methods to stabilize the price of tin was well illustrated in the address of the chairman of the Malayan Chamber of Mines, Mr. A. G. Glenister, at the annual meeting of this body on Wednesday. The keynote of the chairman's remarks was how to amend "the present uneconomic tin price." Mr. Glenister spoke as a producer, and more particularly, a Malayan producer, but the International Tin Conference will be up against the old difficulty that the interests of producers and consumers are not the same and, as the experience of the last year or so has shown, the consumer usually has the last word. Consequently his standpoint, that no proposal should be considered for one moment which would not result in the quick attainment of a price objective high enough to ensure production of the amount of tin which the world requires, invites the query—how much tin does the world require? This, surely, is determined to no small extent by the question of price, so the tendency seems to be to argue in a circle.

At what price level tin becomes "economic" is—for the producer—governed in no small measure by the generally excessive rates of government exaction in the way of export duties, tax, and other media for raising revenue. Any reduction in these levies would, therefore, assist producers quite as much as an increase in the selling price attained by arbitrary measures. But the Malayan Government's resources have been severely strained by its having to finance the war against the bandits and the big drop in prices for both tin and rubber has meant diminishing returns to the exchequer, so that there would not appear to be much room for fiscal manoeuvring. Nevertheless, consuming countries can be expected to stress this as an alternative to establishing an arbitrary minimum price at any forthcoming meetings of the International Tin Organization.

Bolivian exports in June were again slightly lower at 2,960 tons but the six months' total of 18,076 tons is the largest half-yearly figure since 1945. The Minister of Mines, Sr. Juan Lechin, is reported as saying recently "We have become convinced that the only purchasers are the U.S. and England." It is reported from Bonn that West Germany is expected to take part in the International Tin Conference at Geneva at the end of October.

ZINC.—The prospects of the zinc market appear to be somewhat bearishly viewed in the United States. Despite the reduction to 10½ c. per lb. East St. Louis for Prime Western, demand remains sluggish. Consumer demand, it has been pointed out, has been poor during the summer, and autumn prospects are not considered encouraging. Warehouse stocks are said to exceed 18,000 tons. Foreign material is available on the basis of 10 c. per lb. duty paid New York. Towards the end of last week considerable business was done on the Commodity Exchange, with transactions steadily falling, and the metal is being talked down to 10 c., the price of imported zinc. U.S. output in July was 42,473 s.tons compared with 46,413 s.tons in June.

ALUMINIUM.—The recent decision of the U.S. Office of Defence Mobilization to increase the stockpiling allocation in the fourth quarter has been adversely criticized by an N.P.A. spokesman on the grounds that it would not be possible, if stockpiling is increased, to realize the "appreciably larger" supplies foreshadowed for civilian uses: even assuming no power shortages in the autumn, the amounts available to consumers would show little if any increase. Three ministers of the African Gold Coast government are due to arrive in Montreal next week to study the Canadian aluminium industry. They will be guests of Aluminium Ltd. and will visit hydro-electric plants and smelters in Eastern Canada and discuss with the company's officials a plan to harness the Volta River to provide power for the smelter to be erected there. Bauxite reserves in the Gold Coast are estimated at 225,000,000 tons. The governments of the U.K. and the Gold Coast are to bear the cost of erecting the dam, while British and Canadian private companies will pay for the smelter.

MAGNESIUM.—The O.I.T. has fixed the U.S. export quota for magnesium in the final quarter of the year at 3,000 s.tons, the same as in the current quarter.

PLATINUM METALS.—With the reduction in the United States price of platinum to $92-93 per f.oz. reported last week, revised prices for the associated metals per oz. are as follows: paladium $22-23, osmium $200-250 nom.; iridium $185-200 nom., rhodium $125, ruthenium $92-93, indium (+99.9) $2.25.

QUICKSILVER.—A reduction in quicksilver prices seems anticipated following on offers by Yugoslavia and India at well below current prices though the amounts were small. The General Services Administration Emergency Procurement Ser-

vice recently stated that the U.S. purchase quota had been filled. Imports into the U.S. in the second quarter of the year were only about a quarter of those received in the first quarter, the total being 6,431 flasks as against 24,265 and 16,337 flasks in the same period of last year. The suggestion is made that the big producers, Spain and Italy, will find it necessary to cut prices, but this remains to be seen.

TUNGSTEN.—Buying appears to have completely died down this week and so far as can be seen at the moment there is no prospect of business being resumed on any scale in the immediate future. Prices, therefore, are purely nominal.

ZIRCONIUM.—The Allegheny Ludlum Steel Corporation is to expand its production programme of zirconium shapes for atomic energy applications. The present capacity of the company's plant is approximately 120,000 lb. per year, with commitments little short of that figure.

Iron and Steel

Very shortly—possibly before the end of this month—the new Lackenly plant of Dorman Longs will come into operation, adding 500,000 tons to the annual ingot capacity of the British steel industry. Hereafter the firm announce their embarkation upon further development schemes estimated to cost £36,000,000 and raise the total post-war capital investments of the company to £50,000,000.

Such grandiose plans, which can be matched by other big steel companies, bespeak a firm confidence in an expanding market for British steel products. Provision of new plant and modernization of the old has made possible substantial advances in technical efficiency and a reduction of costs which has been translated into terms of lower prices. British steel prices are now below the average levels overseas, and the result is that in face of many import and currency restrictions the export trade is expanding. There are prospects of a reduction of the trade barriers not only with Australia but also with Argentina and Finland.

Home buyers are also developing a more active interest. Most, if not all, the heavy trades, are booming. More adequate supplies of steel are helping the motor trade to raise their production sights. Some of the power plant producers are said to have six to eight years' work in hand. Unless there are cancellations, the shipyards are assured of full employment for three to four years ahead. Locomotive and wagon builders are booked to the limit of their capacity with a large proportion of export orders, and in short visible home requirements are sufficient to sustain a high level of steel production.

Dull patches in the light castings and re-rolling trades are capable of elimination and hopes of an autumn revival are still entertained. Meanwhile the big steel companies are stocking up huge reserves of iron ore and scrap as a cushion against winter requirements and further expansion of pig iron production is planned before the end of the year. A renewal of export business has also restored the sheet trade to full scale activity.

The London Metal Market

(From Our Metal Exchange Correspondent)

Tin on the whole remains a firm market, and, after a moderate fall at the end of last week, has staged a similar recovery. The market in the East has no doubt been supported by American consumer buying, and there has been some continental inquiry. Stocks of tin in official warehouses for the week ended September 5 showed a substantial increase, but these stocks do not appear to weigh on the market and backwardation persists. There is still no news as to when the Conference will meet, but it is thought that such a meeting may take place before the end of this year—if agreement is reached it will doubtless be some considerable time before the supply position is affected, although sentiment may be influenced. The Eastern price on Thursday morning was equivalent to £633¾ per ton c.i.f. Europe.

Copper was somewhat easier in tone at the end of last week, owing to a moderate amount of selling on a market in which buyers were rather scarce. However, prices have since recovered a few pounds per ton although consumers here still seem to be pursuing a cautious buying policy, whilst there is some continental demand. It is understood that negotiations continue between the Chilean government and the United States authorities in regard to the disposal of the former's accumulated stocks and future production, and an early decision is hoped for.

There has been no special feature in the zinc market, inquiries from consumers having been rather meagre, but prices have advanced slightly from the low level seen last Friday.

The demand for lead by consumers in this country and on the Continent is absorbing supplies fairly well, but lead for prompt delivery here is scarce and consumers needing almost immediate delivery are having to pay substantial premiums.

Closing prices and turnovers for the week are given in the following table:

	September 3		September 10	
	Buyers	*Sellers*	*Buyers*	*Sellers*
Tin				
Cash	£623	£625	£610	£612½
Three months	£612½	£615	£605	£607½
Settlement	£624		£610	
Week's turnover	490 tons		565 tons	
Lead				
Current month	£95	£95½	£95¾	£96
Three months	£91	£91¼	£91¼	£91¾
Week's turnover	8,250 tons		3,225 tons	
Zinc				
Current month	£71¼	£71½	£70¾	£70¾
Three months	£71¼	£71½	£70	£70¼
Week's turnover	3,925 tons		5,100 tons	
Copper				
Cash	£223	£230	£230	£230½
Three months	£213½	£214	£213½	£214½
Settlement	£230		£232½	
Week's Turnover	4,600 tons		3,425 tons	

SEPTEMBER 10 PRICES

COPPER, TIN, LEAD AND ZINC

(See our London Metal Exchange report for Thursday's prices)

ANTIMONY

English (99%) delivered, 10 cwt. and over .. .. £225 per ton
Crude (70%) .. .. .. £210 per ton
Ore (60% basis) .. .. .. 20s. — 22s. nom. per unit, c.i.f.

NICKEL

99.5% (home trade) .. .. £483 per ton

OTHER METALS

Aluminium, 99·5% £150 per ton
Bismuth (min. 4 cwt. lots) 16s. 6d. lb.
Cadmium (Empire), 13s. 10d./14s. 4d. lb.
Chromium, 6s. 5d./7s. 6d. lb.
Cobalt, 20s. lb.
Gold, 248s. f.oz.
Iridium, £60 oz. nom.
Magnesium, 2s. 10½d. lb.
Manganese Metal (96%-98%) £280/£295
Osmiridium, £40 oz. nom.
Osmium, £65/70 oz. nom.
Palladium, £7 15s./£8 10s. oz.
Platinum, £27/£33 5s.
Rhodium, £42 10s. oz.
Ruthenium, £25 oz.
Quicksilver, £70/£70 10s. ex-warehouse
Selenium, 30s. 6d. nom. per lb.
Silver 74d. f.oz. spot and f'd.
Tellurium, 15s./16s. lb.

ORES, ALLOYS, ETC.

Bismuth .. .. 40% 6s. 3d. lb. c.i.f.
30% 5s. lb. c.i.f.
Chrome Ore—
Rhodesian Metallurgical (lumpy) £14 8s. 0d. per ton c.i.f.
" " (concentrates) £14 8s. 0d. per ton c.i.f.
" " Refractory £14 0s. 0d. per ton c.i.f.
Baluchistan Metallurgical .. £16 11s. 6d. per ton c.i.f.
Magnesite, ground calcined .. £26 - £27 d/d
Magnesite, Raw .. .. .. £10 - £11 d/d
Molybdenite (85% basis) .. 103s. 10½d. per unit c.i.f.
Wolfram (65%) .. .. .. World buying 305s. - 315s. nom.
" " .. .. .. 327s. 6d. nom. U.K. Selling
Scheelite .. .. World buying 290s. - 300s. nom.
" .. .. 312s. 6d. nom. U.K. Selling
Tungsten Metal Powder (98% Min. W.) .. .. 24s. 3d. nom. per lb. (home)
Ferro-tungsten .. .. .. 21s. 4d. nom. per lb. (home)
Carbide, 4-cwt. lots .. .. £35 13s. 9d. d/d per ton
Ferro-manganese, home .. .. £49 15s. 0d. per ton
Manganese Ore Indian c.i.f. Europe (46%-48%) .. .. .. 7s. 11d. - 8s. 7d. per unit
Brass Wire .. .. 2s. 5½d. per lb. basis
Brass Tubes, solid drawn .. 1s. 10d. per lb. basis

THE MINING MARKETS

(By Our Stock Exchange Correspondent)

Markets were again quiet this week. Gilt edged started steady but eased off later. Anticipation of more potential borrowers entering the list caused prices to be marked down. The better overall revenue position again improved. It is now some £130,000,000 better than for the comparable period last year.

There was little business in Kaffirs and prices continued to drift downward. At a time when it might be expected that more interest be shown in gold shares this is disappointing. Reasons, however, are not far to seek. On the technical side, high working costs, the threat of considerably increased prices for power, and dashed hopes of a higher level for gold, have all had their effect. In addition, the large amount of money required by developing mines has had its inevitable result on thin markets. These factors have offset even the good developments achieved by some of the top grade mines and the uranium prospects which are eventually likely to embrace no less than 22 South African properties.

On a more general basis, there are a variety of other reasons. Politics in the Cape are now reaping the reward of sensationalism. Steady progress in the past has always attracted more money than violent change. Another big factor which has developed since the war is the decline in risk capital available and the continuing swing of investment funds out of the hands of private investors into institutions. While many institutions conduct a broad policy of investment, the responsibility of the form of trusteeship which they represent means that only a comparatively small proportion of their funds can be invested in mines. The private investor has been nearly strangled. What money is still available for investment goes less and less into risk ventures. The type of man who could save before the war and invest his savings is now almost extinct. High taxes and the reduced buying power of the £ mean that many brokers' clients are more likely to come into the market to sell stock than to buy it. Those private individuals fortunate enough to inherit a family estate will probably receive half or less than half the funds held by their fathers. Many of the stocks sold to raise duties must necessarily be those carrying the most risk. It is difficult to see how matters can be improved unless there are fundamental changes in several different directions.

The O.F.S. shares behaved similarly to Rand issues. The news that Harmony will require another £4,000,000 to bring the mine into production caused a heavy fall in price, and reconsideration of last month's poor Welkom figures affected these shares also.

Some increased interest in gold was displayed in other sections. The less certain outlook for international trade may have brought this about. This trend was reflected in a demand for Ashantis and several mines in the miscellaneous group, especially Cam and Motor. The recent good returns from Ashanti and Cam and Motor were well received by the market.

In the diamond group there was some quiet buying of Anglo American Investment Trust and C.A.S.T.S. Platinums, however, were again easier.

A feature in the copper market was the new Bancroft issue. This went well and the shares opened at a premium of 1s. 3d. Shaft sinking is well in hand and the erection of the head gear for No. 1 shaft has been begun. A decision to go ahead with the Kafue Gorge hydro-electric scheme has encouraged hopes that the new power may be ready when the copper belt most needs it for expanding production in a few years' time. The rail transport situation is also being investigated. The good Roan Antelope and Mufulira figures also cheered the market. Optimism concerning the outlook for Esperanza and the progress made in the erection of its plant has been behind recent strong buying. There was a sharp jump in Rhodesia Katanga shares. It is anticipated that some assay results will be available in the near future.

Elsewhere, there were few outstanding features. Wankie New Ordinary remained at around 6d. premium in an unenthusiastic market. The Debentures turned easier but later rallied again to ½ per cent premium.

FINANCE	Price Sept. 9	+ or — on week
African & European	2 1/16	—1/16
Anglo American Corpn.	5⅞	—⅛
Anglo-French	18/-	.....
Anglo Transvaal Consol.	21/3	.....
Central Mining (£1 shrs.)	28/9	.....
Consolidated Goldfields	47/9	—1/3
Consol. Mines Selection	25/-	.....
East Rand Consols	2/6	—1½d
General Mining	3⅛	.....
H.E. Prop	38/9	.....
Henderson's Transvaal	7/6	.....
Johnnies	53/1½	—1/4½
Rand Mines	3 3/16	—1/16
Rand Selection	30/7½	—1/3
Strathmore Consol.	30/-	.....
Union Corp. (2/6 units)	26/6	—9d
Vereeniging Estates	3⅛	—1/16
Writs	33/1½	—7½d
West Wits	40/7½	—1/3
RAND GOLD		
Blyvoors	39/4½	—10½d
Brakpan	10/6	—6d
City Deep	18/9	—7½d
Consol. Main Reef	19/4½	.....
Crown	33/1½	.....
Daggas	3 1/16	—1/16
Doornfontein	20/7½	—10½d
Durban Deep	35/7½	.....
E. Daggas	13/6	.....
E. Geduld (4/- units)	30/7½	—7½d
E. Rand Props	2 1/16	—⅛
Geduld	4½	—1/16
Govt. Areas	12/3	.....
Grootvlei	21/9	.....
Libanon	9/4½	—1½d
Luipaards Vlei	21/6	—3d
Marievale	18/6	.....
Modderfontein East	17/6	.....
New Kleinfontein	19/-	—3d
New Pioneer	17/-	—9d
Randfontein	39/9	—1/9
Robinson Deep	10/9	—3d
Rose Deep	13/-	.....
Simmer & Jack	4/9	.....
S.A. Lands	22/6	—1/3
Springs	4/3	—3d
Stilfontein	26/3	—1/-
Sub Nigel	2½	.....
Van Dyk	5/9	—3d
Venterspost	12/3	—3d
Vlakfontein	13/9	—3d
Vogelstruisbult	31/3	—1/-
West Driefontein	6½	—⅛
W. Rand Consolidated	2 1/16	—1/16
Western Reefs	2 1/16	—1/16
O.F.S.		
Freddies	9/6	—9d
Freddies N.	9/6	—6d
Freddies S.	9/1½	—6d
F. S. Geduld	2 1/16	—⅛
Geoffries	14/3	—6d
Harmony	21/-	—2/-
Loraine	7/9	—9d
Lydenburg Estates	11/9	—3d
Merriespruit	8/1½	—4½d
Middle Wits	15/3	.....
Ofsits	35/7½	.....
President Brand	26/1½	—1/-
President Steyn	21/6	—6d
St. Helena	12/6	—4½d
Virginia Ord.	11/9	—4½d
Welkom	18/4½	—1/6
Western Holdings	3 11/32	—1/16
WEST AFRICAN GOLD		
Amalgamated Banket	1/10½	—¼
Ariston	6/1½	—1½d
Ashanti	23/-	+1/-
Bibiani	5/7½	—1½d
Bremang	2/3	.....
G.C. Main Reef	3/7½xd	.....
G.C. Selection Trust	6/6	+1½d
Konongo	2/7½	+1½d
Lyndhurst Deep	1/-	.....
Marlu	1/6	+1½d
Taquah & Abosso	4/-	+3d
AUSTRALIAN GOLD		
Boulder Perseverance	2/6	.....
Gold Mines of Kalgoorlie	13/3	—3d
Great Boulder Prop.	10/1½	+1½d
Lake View and Star	14/1½	—1½d
Mount Morgan	17/-	—6d
North Kalgurli	7/3	+6d
Sons of Gwalia	6/3	.....
South Kalgurli	6/7½	—3d
Western Mining	13/1½	—1½d
MISCELLANEOUS GOLD		
Cam and Motor	9/7½	+1½d
Champion Reef	4/9	—1½d
Falcon Mines	6/4½	—1½d
Globe & Phoenix	25/3	.....
G.F. Rhodesian	5/1½	+1½d
London & Rhodesian	5/-	.....
Motapa	1/6	.....
Mysore	3/-	—1½d
Nundydroog	6/-	—1½d
Ooregum	4/3	.....
Oroville	11/9	+3d
MISCELLANEOUS GOLD (contd.)		
St. John d'El Rey	27/-	+6d
Zams	26/9	+1/6
DIAMONDS & PLATINUM		
Anglo American Inv.	3 3/32	+1/16
Casts	21/9	+1/9
Cons. Diam. of S.W.A.	4½	.....
De Beers Defd. Bearer	63/6	—9d
De Beers Pfd. Bearer	15½	+½
Pots Platinum	6/9	—6d
Watervaal	11/9	—6d
COPPER		
Chartered	54/3	+1/7½
Esperanza	4/6	+3d
Indian Copper	4/-	.....
Messina	3¼	+⅛
Nchanga	6 1/16	+⅛
Rhod. Anglo-American	48/-xr	—1/6
Rhod. Katanga	12/3	+3/-
Rhodesian Selection	15/4½	+6d
Rhokana	18¾xr	—¼
Rio Tinto	20	+½
Roan Antelope	13/9	+6d
Selection Trust	32/3	—3d
Tanks	60/6	+3/-
Tharsis Sulphur Br.	42/6	+1/3
TIN (Eastern)		
Ayer Hitam	25/-	+3d
Bangrin	8/-xd	+1½d
Gopeng	8/1¼xd	+3d
Hongkong	6/3	.....
Ipoh	16/3	+1/10½
Kamunting	8/3	+3d
Kepong Dredging	4/4½	.....
Kinta Tin Mines	10/3	+1½d
Malayan Dredging	23/-	+6d
Pahang	13/4½	+3d
Pengkalen	8/6	+6d
Petaling	9/-	+3d
Rambutan	10/-	.....
Siamese Tin	8/9xd	+1½d
Southern Kinta	12/6	.....
S. Malayan	23/-	+6d
S. Tronoh	8/3	+1½d
Sungei Kinta	10/-	.....
Tekka Taiping	4/7½	—1½d
Tronoh	22/6	.....
TIN (Nigerian and Miscellaneous)		
Amalgamated Tin	9/10½	+6d
Beralt Tin	27/6	.....
Bisichi	3/10½	.....
British Tin Inv.	13/9	+4½d
Ex-Lands Nigeria	3/7½	.....
TIN (Nigerian and Miscellaneous) contd.		
Geevor Tin	9/9	—3d
Gold & Base Metal	3/4½	.....
Jantar Nigeria	7/7½xd	.....
Jos Tin Area	11/3	.....
Kaduna Prospectors	2/3	.....
Kaduna Syndicate	2/6	+3d
London Tin	5/-	.....
United Tin	2/3	.....
SILVER, LEAD, ZINC		
Broken Hill South	2½	—1/16
Burma Mines	1/4½	.....
Consol. Zinc	25/-	.....
Lake George	9/6	.....
Mount Isa	32/3	—6d
New Broken Hill	22/9	+4½d
North Broken Hill	2½	+1/16
Rhodesian Broken Hill	10/10½	+3d
San Francisco Mines	18/-	—3d
Uruwira	2/9	.....
MISCELLANEOUS BASE METALS & COAL		
Amal. Collieries of S.A.	44/-	—3d
Associated Manganese	47/-	—9d
Cape Asbestos	21/1½	—4½d
C.P. Manganese	56/10½	+2/6
Consol. Murchison	22/-	—7½d
Mashaba	4½d	.....
Natal Navigation	3⅞	.....
Rhod. Monteleo	5/-	+9d
Turner & Newall	55/9	+3d
Wankie	10/6xr	.....
Witbank Colliery	3 11/32xd	.....
CANADIAN MINES		
Dome	$30	.....
Hollinger	$24½	.....
Hudson Bay Mining	$77	.....
International Nickel	$71½	—½
Mining Corpn. of Canada	£3½	—¼
Noranda	$124	+1
Quemont	£6½	.....
Yukon	3/9	+3d
OIL		
Anglo-Iranian	7⅛	+⅛
Apex	38/9	.....
Attock	33/1½	—7½d
Burmah	55/7½	.....
Canadian Eagle	29/7½	+1/6
Mexican Eagle	22/3	+3d
Shell (bearer)	4 1/16	—⅛
Trinidad Leasehold	27/3	.....
T.P.D.	22/6	—1/-
Ultramar	26/1½	—4½d

COMPANY NEWS AND VIEWS

Mufulira and Roan's Excellent Results

The preliminary statements issued by Roan Antelope and Mufulira Copper Mines for the year ended June 30 last show a substantial profit expansion for both companies compared with the preceding year. Roan's profits before tax advanced from £8,281,000 to £11,447,000, while those of Mufulira went ahead from £8,269,000 to £9,575,000.

The sharp advance in Roan Antelope's profits reflect not only the company's increased production from 81,027 l.tons to 87,307 l.tons, but also the higher average price realized per ton over the whole year, which was not far short of £250 per ton against approximately £206 per ton in 1951/52. The improved price received was a strong contributory factor in enabling Mufulira to announce a profit expansion as total production for the year declined slightly from 76,369 l.tons to 76,089 l.tons.

The results achieved in the last two quarters, together with the cumulative totals for the last two years are summarized in the tables below.

	Mar. Qtr. 1953	*June Qtr. 1953*	*Year to June 1953*	*Year to June 1952*
Mufulira	*(l.tons)*	*(l.tons)*	*(l.tons)*	*(l.tons)*
Sales	16,156	20,663	72,981	76,369
	(£000)	*(£000)*	*(£000)*	*(£000)*
Revenue	4,152	5,339	18,188	15,726
Costs	1,836	2,535	8,131	6,683
Difference in value of copper stocks	Cr.30	Cr.174	Cr.479	Cr.293
Surplus	2,346	2,978	10,536	9,336
London Expenses	Cr.20	3	Cr.39	67
Replacements*	250	250	1,000	1,000
Profit before Taxation†	2,116	2,725	9,575	8,269
Roan Antelope	*(l.tons)*	*(l.tons)*	*(l.tons)*	*(l.tons)*
Sales	23,012	26,458	87,307	81,027
	(£000)	*(£000)*	*(£000)*	*(£000)*
Revenue	5,853	6,754	21,706	16,684
Costs	2,569	2,989	9,684	7,191
Difference in value of copper stocks	Cr.17	Cr.43	Cr.402	Cr.142
Surplus	3,301	3,808	12,424	9,635
London expenses	Cr.12	Cr.16	Cr.23	104
Replacements*	250	250	1,000	1,250
Profit before Taxation†	3,063	3,574	11,447	8,281

* Subject to revision when year's accounts considered.
† Estimated.

Although Roan and Mufulira have transferred their domicile from this country to Northern Rhodesia, it did not become effective until July 1 last, so that the above preliminary profit figures will be subjected to U.K. taxation. Nevertheless, the fact that their transfer to Northern Rhodesia became effective from the beginning of the current financial year, will be of considerable value in providing a shock absorber for any decline experienced during the year in the average price realized per ton copper. Since the dealings in copper on the London Metal Exchange the price of copper has been more or less stabilized at approximately £225 per ton which, if not equivalent to the average price received during the year under review, is a good deal better than the average price received during 1951-52 of around £206 per ton, at which level the companies showed handsome profits and paid U.K. taxation as well.

The longer term view, apart from considerations of price, concern labour, power and fuel. The labour position has been rather difficult to assess in recent months. The recent deterioration in relationships may be due to the African trade unions going through a painful period of adjustment to their newly acquired recognition and authority, or it may have its reasons rooted in the newly constituted Central African Federation. New problems, almost by definition, tend to create more alarm and despondency than those which arise from familiar situations, no matter in what shape the particular dispute is cast. And the current copperbelt labour problems seen against a much wider background do not appear to present intractable problems.

In so far as power shortages are concerned the big hydro-electric project at Kafue is being proceeded with while an interim arrangement has been made with Union Minière to provide power supplies to deal with the increased production until the Kafue project, and subsequently the Kariba Gorge project, are in operation.

Shortage of coal from Wankie has been a persistent problem, a solution of which appears more likely now that Anglo American Corporation of South Africa has taken over the company and has taken steps to raise over £4,000,000 new capital to expand production. Even so, the shortage of coal from Wankie may continue for some time and may even be aggravated by shortage of rail facilities from time to time.

With regard to the price of copper, perhaps the short answer may well be forthcoming from autumn buying in the United States. How consumers view the present position is dealt with at greater length in our Notes and Comments.

London Tin's Larger Net Income

The full accounts of London Tin Corporation for the year ended April 30 last confirm the impression indicated in a preliminary profit statement, discussed in these columns in our issue of May 29 last that the corporation had enjoyed a prosperous year.

A feature of the profit and loss account was the increase in the gross amounts received from dividends, investments, and interest totalling £1,297,954 against £1,150,994 and profits on investments, less amounts written off of £147,291 (£83,304), which fattened the revenue total to £1,445,245 compared with £1,234,298. After providing for the usual administration and other charges including tax liabilities amounting to £910,000 (£723,070), net income for the year was £448,893 against £416,507. This latter figure, however, excludes £38,613 arising from recoverable income tax. There was no allocation made to general reserve (£41,500), the dividend of 22 per cent paid on June 23 last absorbed £437,807 (against £379,915 required to pay 20 per cent), leaving the carry forward higher at £302,160 compared with £291,074.

The balance sheet revealed a strong financial position. Current assets stand at £7,552,172 (£6,847,924) and include quoted investments of £3,622,061 (£3,233,332), having a market value of £4,883,542, and cash balances amounting to £3,278,588 against £2,970,039. Current liabilities were slightly higher, £1,284,481 compared with £1,160,808 in the preceding year.

In many respects the report and accounts under review are very much out of date. For during the greater part of the period covered by the Corporation's accounts, the price of tin was at least £300 per ton above the quotations prevailing since the end of the Corporation's financial year. This explains, in some measure at any rate, the basis for the satisfactory results announced. But, too, it is also a signpost to the current year's results which, with tin at its present levels, can hardly be expected to measure up to those obtained during the year under review.

Kinta Kellas Disappoints

Loss of dredging time and the lower grade of ground worked were the chief reasons accounting for the disappointing results announced by Kinta Kellas Tin Dredging for the year ended March 31 last. The question of the severe slump in the tin price from £1,610 in April, 1951, to £950 per ton a year later affected the company's position a good deal more than many other companies because at the time of high tin values, it undertook the very necessary task of completely overhauling its dredge thus incurring expenditure at a time when costs were inflated and the price of its product was falling rapidly. The impact of the loss of dredging time, the lower grade of ground worked and the heavy expenditure is clearly shown in the table immediately below.

Year to Mar. 31	*Dredging Time (hours)*	*Per Cubic Yard Dredged (000)*	*Yield (lb.)*	*Output (Tin Ore) (tons)*	*Per Ton Tin Ore Cost £*	*Per Ton Tin Ore Price £*
1953	5,384	1,079.6	0.39	184	577	532
1952	5,444	1,062.1	0.50	237	362	581
1951	6,587	1,243.2	0.45	249	312	557

These repercussions followed through to the profit and loss account and their stultifying effect on financial results, shown in the table immediately overleaf, calls for little comment.

Year to Mar. 31	Tin Proceeds £	Gross Revenue £	Mining* Costs £	Taxation £	Net Profit £	Dividend %
1953	104,325	116,224	113,505	Nil	609	Nil
1952	137,748	147,266	98,128	21,035	24,590	20
1951	138,605	144,083	90,039	35,006	15,689	25

* Including royalty payments depreciation.

However, a much more cheering production picture can be presented by referring to the output for the first five months of the current year which at 110¾ tons is more than double the corresponding figure for the year under review of 59 tons. Yet since the begining of the company's current year, the price of tin has fallen steadily and currently is showing resistance to levels lower than £600-£610 per ton. While this means the company will not be reaping the benefits available in the preceding year, the greater output together with a much reduced expenditure may well fulfil the chairman's hope expressed in his annual statement to shareholders "that the current year may be productive once again of a reasonable profit."

Rand and OFS Returns for August

There was rather widespread feeling—or was it hope?—that the August returns of the South African gold producers would indicate a general all-round improvement. In fact, neither production levels nor cost revealed any marked change.

Company	August, 1953 Tons (000)	Yield (oz.)	Profit (£000)	Yr. ends	Current Financial Year Total to Date Tons (000)	Yield (oz.)	Profit (£000)	Last Financial Year Total to Date Tons (000)	Yield (oz.)	Profit (£000)
Gold Fields										
Libanon	85	17,154	42·8	J	168	33,964	84·7	166	33,203	84·5
Luipaards Vlei	108	20,017	42·4	J	216	40,054	87·2	207	38,876	103·6
Rietfontein	27	6,005	24·6	D	213	47,593	202·3	217	48,142	221·3
Robinson	104	20,323	12·6	D	783	151,557	104·4	906	148,361	94·8
Simmer & Jack	125	19,993	12·7	D	973	57,831	101·8	993	158,253	130·5
Sub Nigel	67	22,111	103·0	J	134	44,389	206·9	135	46,882	248·9
Venterspost	105	24,570	56	J	208	48,724	111·6	209	47,545	125·2
Vlakfontein	38	13,683	73·5	D	292	106,288	568·6	297	110,590	631·9
Vogels	100	25,154	101·4	D	773	195,622	783·6	633	165,449	644·3
West Drei	45	32,045	250·1	J	87	59,838	483·6	51	28,996	196·6
Anglo American*										
Brakpan	117	20,926	26·3	D	918	164,341	176·3	936	169,550	296·9
Daggas	219	51,466	325·9	D	1756	414,181	2668·1	1867	445,033	3156·5
East Daggas	94	16,177	49·3	D	724	126,037	387·1	773	138,202	509
S. A. Lands	101	18,469	52·3	D	800	145,746	409·4	889	160,293	572·2
Springs	146	19,976	9·8	D	1181	162,577	85·1	1319	172,755	151·7
Welkom	69	11,957	L 6·6	D	496	97,117	107·3	383	64,497	L 58·9
Western Hldgs	37	9,649	10·0	D	70	18,063	15	—	—	—
W. Reef Ex.	111	22,496	77·1	D	868	178,098	643·3	893	186,804	826
Central Mining										
Blyvoor	101	59,829	495·4	J	206	122,063	1014·6	218	132,265	1160·4
City Deep	160	30,749	18·1	D	1272	246,158	178·0	1234	248,296	208·5
Consol M. R.	176	24,045	19·8	J	352	48,253	39·4	373	51,956	64·6
Crown	281	44,060	43·8	D	2144	341,820	311·1	2142	346,760	305·4
D. Roodeport	182	29,209	51·7	D	1428	241,171	531·4	1441	246,711	669·1
East Rand Prop.	199	44,987	132·9	D	1512	332,880	865·7	1667	356,609	1193·4
Modder B.	57	5,663	1·1	D	436	46,417	12·6	454	50,155	53·2
Modder East	117	13,121	14·5	J	242	27,207	32·5	239	27,545	46·2
Rose Deep	72	10,846	10·2	D	588	87,244	64·3	669	92,968	83·0
Welgedacht	34	4,245	3·5	J	69	8,571	7·5	69	8,487	9
J.C.I.*										
E. Champ D'Or	24	3,698	L 3·0	D	194	31,120	6·7	245	37,175	66·4
Govt. G.M.A.	246	33,198	40·0	D	1954	266,497	440·6	1940	256,503	397·9
New State	21	3,286	1·0	D	238	36,221	8·0	364	5,188	8·2
Randfontein	310	38,840	25·1	D	2453	313,905	217·0	2817	332,807	235·6
Wit Gold	29	4,008	L16·4	D	435	48,069	L 74·2	478	57,092	19·8
Freddies North†	25	4,014	L21·4	D	47	7,172	L 46·9	—	—	—
Freddies South†	27	5,240	L19·3	D	61	10,408	L 34·8	—	—	—
Union										
East Geduld	138	41,402	310·4	D	1089	326,699	2433·7	1161	348,342	2757·4
Geduld Prop.	94	15,054	30·7	D	763	120,703	258·4	839	121,754	286·3
Grootvlei	190	40,383	235·3	D	1478	315,133	1854·9	1555	336,917	2163·4
Marievale	63	15,281	65·1	D	500	122,244	530·9	485	121,573	565·0
St. Helena	68	13,772	27·6	D	507	101,304	166·0	376	74,225	37·1
Van Dyk	85	13,681	L 9·3	D	705	113,866	6·2	858	123,922	99·5
General Mining*										
S. Roodepoort	28	5,989	20·1	J	57	12,149	40·9	56	12,463	47·5
W. Rand Cons.	227	31,093	83·6	D	1793	250,788	715·8	1694	264,553	988·5
Anglo Transvaal*										
N. Klerksdorp	11	1,492	0·7	D	83	11,371	6·7	90	10,055	8·2
Rand Leases	162	27,704	14·2	J	322	55,146	26·5	373	62,375	139·1
Village M.R.	34	5,344	12·0	J	68	10,639	24·0	67	10,599	30·1
Others										
N. Kleinfontein	112	14,329	24·7	D	856	110,723	210·0	850	111,845	549·7
Spaarwater										
Stilfontein	68	20,750	107·2	D	501	144,318	705·7	—	—	—
W. Nigel*	17	3,877	8·3	J	34	7,708	14·3	34	—	13·6

Notes.—Profit figures are in all cases figures of working profit excluding profit from sale of gold at premium prices. In case of groups marked with an asterisk (*) profit includes sundry revenue. Profit figures preceded by L indicate a loss. † Excluding development expenditure.

There were however one or two exceptions but these were confined for the most part to the newer producers. In particular, West Driefontein, the young Far Western producer, was again able to announce a higher mill throughput at 45,000 tons, and although costs rose by 6d. to 65s. the monthly working profit figure of 250,115 was yet another record and compared with 233,535 in July. Western Holdings in the Anglo American Group improved its position, the working profit figure announced of 10,003 being double the July figure. Stilfontein also made a better showing as did St. Helena, but Welkom which commenced production at approximately the same time as St. Helena surprised the market by announcing a loss on the month's operation of 6,648 against a profit of 16,304 in July. The loss was incurred in spite of an increase in the tonnage milled by 3,000 to 69,000 tons and a decrease in working profits to 44s. 10d. per ton compared with 45s. 2d. per ton in July.

Freddies North and Freddies South still suffering from the teething troubles arising from coming into production earlier than is considered normal, both announced further working losses. The figures shown in the table below, as indicated in the footnote show that development expenditure has been excluded.

Company Shorts

Harmony Requires £4,100,000 New Funds.—Harmony Gold Mining has issued a circular to shareholders setting out the reasons why new money amounting to £4,100,000 is needed to bring the mine into production which is expected some time in the latter half of next year. It will be recalled that the borrowing powers of the board were raised from £2,000,000 to £6,000,000 at the extraordinary general meeting held on July 31.

Details of the new proposals, which will be considered at an extraordinary general meeting to be held on September 25 next, are given in this issue on page 308.

Morning Star's Dividend Helps Mt. Coolon Pay 6d.—Morning Star (G.M.A.) which paid a dividend of 1s. (Aust.) per 4s. share on the £A100,000 issued capital on July 7 last has now declared a further distribution of 6d. (Aust.) per share payable October 16 to all shareholders registered on September 24. In making this announcement the company states that when the electrification of the mine is completed (State electricity power was made available to the mine on September 3), the full effect of power saving is expected to be 33s. per ton. Further, the current rate of profits continues to be satisfactory, but until the company's share of the recoverable value of the transmission line is known and also the cost of additional equipment for the new internal shaft is known, the directors consider it prudent to conserve funds and pay only 6d. per share at this time.

This payment has made all the difference to Mount Coolon whose main income producing asset is its holding of 102,100 shares of Morning Star. During 1952 Mount Coolon received no dividend from Morning Star but the latest declaration will be the third received from Morning Star since the end of its financial year and is almost wholly responsible for the declaration by Mount Coolon to pay 6d. per 10s. share on its £A300,000 issued capital on October 30 to all those registered on September 24 next.

The latest published report and accounts of Morning Star (G.M.A.) and Mount Coolon were discussed in our issue of August 28.

Marsman Mine Returns for July.—Marsman and Company Inc., operating gold mines in the Philippines, have announced production figures for July.

Itogon Mining Company, Baguio, milled 15,714 tons yielding 3,750 oz. compared with 16,190 tons yielding 3,068 oz. Although the mill throughput was lower production was the highest since last January.

Coco Grove Inc., Parcales, Camarines Norte, dredged 72,500 cu. yds. for a recovery of 264 oz. representing a perceptible decrease on the June figures of 162,000 cu. yd. yielding 485 oz. This was due to the dredge being laid up for 15 days for repairs but it was announced that a better grade area is now being worked and an improvement in recovery is expected for August.

San Mauricio, Jose Panganiban, Camarines Norte, milled 9,319 tons yielding 5,168 oz. against 9,220 tons yielding 4,988 oz. in June. These very satisfactory results arise from the continued good values exposed on the opening up of the Sta. Monica No. 2 Vein.

Esperanza Copper Unaffected by Earthquake.—The directors of the Esperanza Copper and Sulphur Co. Ltd. report that the mining areas of their subsidiary, Cyprus Sulphur and Copper Co. Ltd., were affected in no way by yesterday's earthquake. The district in which the company's mines are situated has always been immune from earth tremors.

HARMONY GOLD MINING COMPANY LIMITED

(Incorporated in the Union of South Africa)

NOTICE TO SHAREHOLDERS

NOTICE IS HEREBY GIVEN that an Extraordinary General Meeting of Harmony Gold Mining Company Limited will be held in the Board Room, Second Floor, The Corner House, Johannesburg, on September 25, 1953, at 11 a.m. to consider and, if thought fit, to pass with or without modification, in the manner required for the passing of a Special Resolution in terms of the Companies Act, 1926, as amended, of the Union of South Africa, the following resolution as a Special Resolution, namely:

"That the Authorized Capital of the Company be increased from £3,750,000 (Three million seven hundred and fifty thousand pounds) divided into 15,000,000 (Fifteen million) shares of 5s. each to £4,500,000 (Four million five hundred thousand pounds) divided into 18,000,000 (Eighteen million) shares of 5s. each, by the creation of 3,000,000 (Three million) new shares of 5s. each, all of which new shares shall, when issued, rank *pari passu* in all respects with the 15,000,000 (Fifteen million) shares constituting the present Capital of the Company."

And further more to consider and, if thought fit, to pass with or without modification, the following Ordinary Resolutions, namely:

"That the Directors of the Company be and they are hereby authorized—

(i) To issue, subject to the consent of the United Kingdom Treasury being obtained to issue shares in terms hereof in the United Kingdom, up to the maximum of 4,400,000 shares (being 1,400,000 reserve shares together with the 3,000,000 new shares), to such person or persons and at such price or prices and upon such terms and conditions as the Directors may determine.

(ii) To negotiate and enter into an Underwriting Agreement on terms to be agreed upon, and to allot and issue to the Underwriters or their Nominees, in terms of any such Underwriting Agreement, any shares or unsecured convertible notes not taken up in response to any offer that may be made in connection with the aforementioned issue of up to a maximum of 4,400,000 shares, including all shares and unsecured convertible notes representing unallotted fractions arising out of any such offer.

(iii) To do all such things as may be necessary to give effect to the aforegoing Resolutions, including the power to modify the terms of the aforementioned offer to such extent as may be requisite in order to comply with any requirements of the United Kingdom Treasury."

The abovementioned increase of capital is recommended for the reasons stated in the circular to shareholders.

The Transfer Books and Register of Members of the Company will be closed from September 19 to September 25, 1953, both days inclusive.

In terms of the Companies Act, as amended, a member entitled to attend and vote at a meeting may appoint a proxy, or where allowed, one or more proxies to attend and vote on a poll, and speak in his stead. A proxy need not be a member of the Company.

By Order of the Board,
RAND MINES LIMITED,
Secretaries.
per J. S. Mitchley.

Registered Office:
The Corner House,
Commissioner Street,
Johannesburg, Transvaal.

September 2, 1953.

DIVIDENDS

Anglo American Corporation of South Africa 20% *i* (Oct. 22)
Beralt Tin and Wolfram 100%
Bangrin Tin Dredging 5% *i*
Central Provinces Manganese Ore 17½% *i* * (Oct. 1)
Filani (Nigeria) Tin 6½% * (Oct. 14)
Gold Coast Main Reef 5% *i* (Sept. 30)
Malayan Tin Dredging 1s. 6d. *i*
Potgietersrust Platinums 6d. (Oct. 8)
Siamese Tin Syndicate 12½% *i*
Southern Malayan Tin Dredging 1s. 6d. *i*
Tronoh Mines 20% *i* (Oct. 2)
Waterval (Rustenburg) Platinum 33⅓% (Oct. 8)

i interim *tax free

COLONIAL GEOLOGICAL SURVEYS

Directorate of Colonial Geological Surveys invite applications for the following appointments: Post (a) SENIOR SCIENTIFIC OFFICER. Ref. F.434/53A. Qualifications: 1st or 2nd Class Honours Degree in Chemistry, or equivalent. Required to take part in a special investigaton needing a sound knowledge of mineral chemistry and a good general experience of mineral analysis. A knowledge of physical methods applicable to inorganic analysis would be an advantage. Post (b) SCIENTIFIC OFFICER. Ref. F.435/53A. Qualifications: as for Post (a) with sound knowledge of Mineral Chemistry and interest in and some experience of mineral analysis. Required to undertake analysis and examination of minerals and their products, rocks, fuels, etc., and to assist in development of suitable methods. Post (c) ASSISTANT EXPERIMENTAL OFFICER. Ref. F.436/53A. Qualifications: General Certificate of Education with scientific subjects, preferably at Advanced level or equivalent. Preference given to University degree with Chemistry as principal subject and/or experience of applied inorganic analysis. Required for duties in connection with mineral analysis and investigations. **Salaries:** S.S.O. £750 x 30—£950 (males); S.O. £400 x 25—£450 x 30—£650 (males). Under review; point of entry determined by quals. and experience. F.S.S.U. Superannuation. A.E.O. (min. age 18), £250 (at 18) x 25—£475 x 20—£555. Highest point of entry £450 (i.e., salary for age 25). All salary scales above subject to pay addition of 10 per cent on first £500 and 5 per cent between £500—£1,000. Application forms from M.L.N.S., Technical and Scientific Register (K), 26 King Street, London, S.W.1, quoting appropriate reference. Closing date October 3, 1953.

WIGAN AND DISTRICT MINING AND TECHNICAL COLLEGE

The Governing Body invites applications for a post as LECTURER IN THE DEPARTMENT OF MINING AND GEOLOGY. Duties commence as soon as possible.

Candidates should possess a degree or a recognized diploma in Mining. Salary in accordance with the Burnham Technical Scale for Assistants Grade 'B.'

Further particulars and application form will be sent by the undersigned on receipt of a stamped addressed foolscap envelope. Last date for receipt of applications: Monday, September 28, 1953. Applications not on the form provided will be disregarded.

E. C. SMITH,
Principal.

September 3, 1953.

XANTHATES FOR FLOTATION
of
BRITISH MANUFACTURE
are now available from
ROBINSON BROTHERS LIMITED
Ryders Green, West Bromwich

Telegrams: "Chemicals," West Bromwich.
Telephone: West Bromwich 2451/2.

FIRE!
HIS LIFE LOST FOR LACK OF
NU-SWIFT!

"Door jammed in crash . . . car blazing but window open . . . he could have been saved if only . . . it was a dreadful sight . . . I enclose order . . I shall never be without my Nu-Swift."

NU-SWIFT LTD · ELLAND · YORKS
In Every Ship of the Royal Navy

Metal and Mineral Trades

Contractors for Ores · Concentrates · Residues
containing
LEAD
ZINC · COPPER · ANTIMONY · WOLFRAM

CREECHURCH HOUSE, LONDON, E.C.3
Telephone: AVENUE 5341
Cables: ORMINLAZ LONDON

LEOPOLD LAZARUS LTD

Offices at: SYDNEY, CALCUTTA and JOHANNESBURG

THE COMMERCIAL METAL COMPANY LTD
66 GRESHAM STREET, LONDON, E.C.2
ORES, METALS, ALLOYS, STEEL, CHEMICALS AND ALUMINIUM POWDERS
Telephone: MONARCH 0211 (8 lines) **(Members of the London Metal Exchange)** *Cables:* COMETALCO LONDON

MINING & CHEMICAL PRODUCTS, LTD.
MANFIELD HOUSE, 376, STRAND, W.C.2
Telephone: Temple Bar 6511/3 Works: ALPERTON
Telegrams: "MINCHEPRO, LONDON" WEMBLEY, MIDDLESEX
Buyers of Silver Ores and Concentrates
Smelters and Refiners of
BISMUTH
ORES, RESIDUES & METAL
Manufacturers of:
FUSIBLE ALLOYS, SOLDER, WHITE METALS, ANODES OF TIN, CADMIUM and ZINC IN ALL SHAPES
Importers and Distributors of:
ARSENIC . BISMUTH . CADMIUM INDIUM . SELENIUM . TELLURIUM

ROKKER & STANTON LTD.
DRAYTON HOUSE, GORDON STREET
LONDON, W.C.1
Metal Stockists & Shippers
for
BRASS, COPPER, ALUMINIUM AND NICKEL SILVER
in
Sheets, Rods, Tubes, Strip, Wire, etc.
Associated Companies in Holland and Belgium, also Regd. in South Africa and Rhodesia
Tel: EUS 4751/2 Cables: BENTLY 2nd; A.B.C.6
Grams: ROKKER, WESTCENT, LONDON

EASTERN SMELTING CO. LTD.
CAPITAL—AUTHORISED £500,000: £435,000 ISSUED
Head Office: **ST. SWITHIN'S HOUSE, 11/12 ST. SWITHIN'S LANE, LONDON, E.C.4**
Telephone: MANsion House 2164/7 *Telegrams:* TIMAMASA, PHONE LONDON
TIN SMELTERS
BRANCHES THROUGHOUT THE FEDERATION OF MALAYA
Sole Selling Agents: **VIVIAN, YOUNGER & BOND, LIMITED, PRINCES HOUSE, 95 GRESHAM STREET, LONDON, E.C.2**
Telephone: MONarch 7221/7

ROURA & FORGAS, LTD. Telephone No: GERRARD 9641

Sole Sterling Area Suppliers of

ITALIAN QUICKSILVER

PRODUCED BY MONTE AMIATA, S.M.P.A.

COLQUHOUN HOUSE,
27/37 BROADWICK STREET, LONDON, W.1

MAYBANK METALS LTD.

This Company backed with the vast experience gained in a 100 YEARS of progressive trading, will expedite all orders . . .

THE BUYING OF MIXED OR SORTED NON-FERROUS SCRAP METALS and Supplying of Finely Graded Non-Ferrous Scrap to Your Requirements.

MAYBANK METALS LTD.

STAR WORKS, SPURGEON STREET, SOUTHWARK
LONDON, S.E.1 Telephone: HOP 2432/3 HOP 4212/3/4

H. BARNETT LTD.

VICTOR ROAD, LONDON, N.7.
IMPORT : EXPORT
Phone: ARCHWAY 5461 (5 lines) Established 1865
WE SPECIALISE IN ALL NON-FERROUS SCRAP AND INGOT METALS

LEO RAPP LTD. *NON-FERROUS METALS*
METAG LTD. *NON-FERROUS TUBES*
LEO RAPP (Steel) LTD. *STEEL STOCKISTS*

Buyers and Sellers

All at: 60a PURLEY AVENUE, LONDON, N.W.2
Telephone: GLAdstone 6393/4/5/6

EVERITT & Co. LTD. 40 CHAPEL STREET LIVERPOOL
Teleg. Address: Persistent, Liverpool Phone: 2995 Central

SPECIALITY

MANGANESE PEROXIDE ORES,

We are buyers of :—
WOLFRAM, SCHEELITE, MOLYBDENITE
VANADIUM, ILMENITE, RUTILE,
ZIRCONIUM and TANTALITE ORES

Suppliers of :—
FERRO-ALLOYS & METALS NON-FERROUS ALLOYS

LEONARD COHEN LTD.

GOLD, SILVER AND THE PLATINUM METALS
ORES, CONCENTRATES AND RESIDUES
METAL HARDENERS
NON-FERROUS METAL INGOTS

London Office : I HAY HILL, W.1
Telephone : GROSVENOR 6284

Works : PORTH, GLAM
Telephone : PORTH 280

ENTORES, LIMITED

KINGS HOUSE, 36 & 37 KING STREET,
LONDON, E.C.2

NON-FERROUS METALS
ORES · RESIDUES

Telegrams : Entores, Phone, London
Telephone : MONarch 3415

HENEAGE METALS

for Quality Ingots IN BRASS, GUN METAL & PHOSPHOR BRONZE.

PHONE ASTON CROSS 1177/8
HENEAGE METALS LTD. HENEAGE ST. BIRMINGHAM.

THE STRAITS TRADING COMPANY, LIMITED

Head Office :
P.O. Box 700, OCEAN BUILDING, SINGAPORE

Works :
SINGAPORE & PENANG

"The Straits Trading Co., Ltd."
Brand of Straits Tin

THE BRITISH TIN SMELTING COMPANY, LIMITED

Works : LITHERLAND, LIVERPOOL

Smelters of Non-ferrous Residues and Scrap

London Agents :
W. E. MOULSDALE & CO., LTD.
2 Chantrey House, Eccleston Street, London, S.W.1
Cables : Wemoulanco, London Telephone : SLOane 7288/9

THE BRITISH METAL CORPORATION LTD
BMC

LONDON · MONTREAL · TORONTO
VANCOUVER · SYDNEY · PERTH
MELBOURNE · CALCUTTA · BOMBAY
KARACHI · LAHORE · JOHANNESBURG
SALISBURY · BULAWAYO

ASSOCIATES :

C. TENNANT, SONS & CO. OF NEW YORK, NEW YORK
VIVIAN YOUNGER & BOND LIMITED, LONDON AND NIGERIA
HENRY GARDNER & CO. LIMITED, LONDON, CANADA AND MALAYA

The Group trades in and markets non-ferrous ores, metals and minerals, many kinds of produce, timber and other materials ; it provides coal-washing plant, ventilation plant and other specialist engineering equipment; and it furnishes allied shipping, insurance, secretarial, financial, technical and statistical services.

PRINCES HOUSE
93 GRESHAM STREET, LONDON, E.C.2

TELEGRAMS : *Brimetacor, London* CABLES : *Brimetacor, London* TELEPHONE : *MONarch* 8055
Branches at BIRMINGHAM and SWANSEA

Sellers of
GRADED SCRAP & RE-MELTED SPELTER
Buyers of
NON-FERROUS METALS, RESIDUE SCRAP & ORES
FOR KEENEST PRICES & MOST SPEEDY SERVICE CONTACT
ELTON LEVY
& COMPANY LIMITED
Head Office: 1-4 St. Ermin's (West Side) Caxton St., London, S.W.1
Phone: ABBEY 6582/3/4 Grams: Eppenleco, Sowest, London

GEORGE T. HOLLOWAY Co. LTD.
Metallurgists & Assayers
ORE TESTING, WORKS AND METALLURGICAL RESEARCH LABORATORIES
Atlas Road, Victoria Road, Acton, LONDON, N.W.10
Telephone : ELGAR 5202 *Grams and Cables :* NEOLITHIC LONDON

DEERING PRODUCTS LTD.
8 GREAT SMITH STREET, LONDON, S.W.1
ORES - MINERALS - REFRACTORY RAW MATERIALS
Telephone : ABBEY 2681/2 Cables : PRODEERING, LONDON

ZINC SHAVINGS
GRANULATED & POWDERED NON-FERROUS METALS
" Lead Wool " for Pipe-jointing.
Metallic Packing for Pumps, etc.
THE LEAD WOOL CO., LTD.
SNODLAND KENT
Telephone: Snodland 84216 & 7 Telegrams: " Strength, Phone, Snodland "

we buy
CONCENTRATES
ORES RESIDUES
containing
Base and Precious METALS

E. M. JACOB & CO. LTD.
Members of the London Metal Exchange
HANOVER HOUSE, 73-78 HIGH HOLBORN, LONDON, W.C.1
Telephone CHAncery 3625 (5 lines) *Cables:* JACOMETA, LONDON

For Optimum Hardness and Strength

NITRIDED NITRALLOY STEEL

Particulars from:

NITRALLOY LIMITED, 25 TAPTONVILLE ROAD, SHEFFIELD, 10

Telephone: 60689 Sheffield Telegrams: Nitralloy, Sheffield

International Smelters and Buyers of

NON-FERROUS SCRAP METALS AND RESIDUES

TIN
LEAD
WHITEMETAL
SOLDER
GUNMETAL
COPPER

THE EYRE SMELTING CO LTD

Tandem Works, Merton Abbey, London, S.W.19

Phone: Mitcham 2031 Wire: Eyrsmeltin, Phone, London

PLATT METALS LTD.

METAL MANUFACTURERS and MERCHANTS

Buyers of

BRASS ROD SWARF AND SCRAP, and all descriptions of NON-FERROUS SCRAP METALS, BORINGS AND RESIDUES

Sellers of

BILLETS AND INGOTS TO ANY REQUIRED COMPOSITION, GRADED NON-FERROUS SCRAP METALS

METALEX WORKS, Great Cambridge Road, ENFIELD, Mddx.

Telephone: HOWard 3351 (5 lines) Telegrams: Walton, Enfield

250 *Pages* *Price* 7/6 ($1·00)

The Mining Journal

ANNUAL REVIEW — 1953 EDITION

IS NOW ON SALE :: PRICE 7/6

This comprehensive Review which—like the weekly issue of the MINING JOURNAL—is read in over 60 countries, contains over 100 articles falling into the following main groups:

- **Technical Developments in the Mining Industry.** Separate articles deal with the latest advances in Exploration, Mining, Ore Dressing, Reduction and Refining, and in Alloys and Metallic Powders.
- **Economic Review of the Metals** including articles on Gold, Silver, Platinum, Copper, Tin, Lead, Zinc, Aluminium, Magnesium, Titanium, Nickel, Cobalt, Manganese, Molybdenum, Tungsten, Vanadium, Columbium, Tantalum, Beryllium, Antimony, and Asbestos; also Iron and Steel, Coal, Oil, and Diamonds.
- **Country by Country Review of the Mining Industry during 1952,** including despatches from our correspondents in South Africa, South-West Africa, Southern Rhodesia, Northern Rhodesia, East Africa, Congo, Mozambique, Canada, United States, Brazil, Australia, Malaya, India, Ceylon, Spain, Portugal, and Norway.

  Also articles giving authoritative reports on progress in Bolivia, Argentina, the Caribbean, Indonesia, Yugoslavia, and the United Kingdom.
- **Progress Reports on over 100 of the Empire's principal Mining Companies.**

Orders may be placed through Newsagents or sent direct to:—

THE PUBLISHER, The Mining Journal, 15 Wilson Street, Moorgate, London, E.C.2

Subscribers to the weekly edition receive the Annual Review automatically, without further payment.

MACHINERY & EQUIPMENT DIRECTORY

Buyers will find the addresses of the companies listed below in the advertisement pages of our recent issues. Alternatively, enquiries may be addressed to *The Mining Journal*, 15 Wilson Street, London, E.C.2. Phone: MONarch 2567.

AGITATORS
Denver Equipment Co. Ltd.
Head Wrightson & Co. Ltd.
Wilfley Mining Machinery Co. Ltd.

AIRCRAFT
The Bristol Aeroplane Co. Ltd.

ALTERNATORS — TURBO
Richardsons Westgarth (H'pool) Ltd.

ALUMINIUM FABRICATORS
T. I. Aluminium Ltd.

BALL MILLS & LINERS
Fraser & Chalmers Eng'g Wks.
Head Wrightson & Co. Ltd.

BATTERIES — ELECTRIC
Britannia Batteries Ltd.

BELTING — RUBBER & FIRE RESISTANT
British Tyre & Rubber Co. Ltd.
Dominion Rubber Co. Ltd.
Goodyear Tyre and Rubber Co. (G.B.) Ltd.
Rubber Improvement Ltd.

BOILERS
Richardsons Westgarth (H'pool) Ltd.
Ward (Thos. W.) Ltd.

BOOKS — TECHNICAL
Foyles Ltd.

BOOTS — MINER'S SAFETY
Wilkins & Denton Ltd.

BOREHOLE & DRILLING CONTRACTORS
Associated Drilling & Supply Co. (Overseas) Ltd.
Craelius Co. Ltd.
Thom (John) Ltd.

BRAKE & CLUTCH LININGS
Small & Parkes Ltd.

CABLES
The General Electric Co. Ltd.

CABLEWAYS & ROPEWAYS
Ceretti & Tanfani Ropeway Co. Ltd.

CALCINING PLANT
Head Wrightson & Co. Ltd.
Wilfley Mining Machinery Co. Ltd.

CASTINGS
Butterley Co. Ltd.
Hadfields Ltd.

CEMENTATION
Cementation Co. Ltd.

CHEMICALS
I.C.I. (Gen. Chem. Div.)

CLASSIFIERS
Denver Equipment Co. Ltd.
Head Wrightson & Co. Ltd.
Holman Bros. Ltd.

CLEANING RAGS
Austin (E.) & Sons (London) Ltd.

CLUTCHES — FRICTION
British Belting & Asbestos Ltd.
Small & Parkes Ltd.
Wigglesworth (F.) & Co. Ltd.

COAL & COKE HANDLING PLANT
The Birtley Co. Ltd.
Head Wrightson & Co. Ltd.

COAL CUTTERS
Joy-Sullivan Ltd.

COAL WASHING PLANT
The Birtley Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Head Wrightson & Co. Ltd.

COMPRESSORS — AIR
British Thomson-Houston Co. Ltd.
Climax Rock Drill & Eng'g Wks. Ltd.
Consolidated Pneumatic Tool Co. Ltd.
English Electric Co. Ltd.
Holman Bros. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
Ward (Thos. W.) Ltd.

CONCENTRATING TABLES
Davies Magnet Works Ltd.
Fraser & Chalmers Eng'g Wks.
Holman Bros. Ltd.
Knapp & Bates Ltd.
Wilfley Mining Machinery Co. Ltd.

CONCRETE MIXERS
Ransomes & Rapier Ltd.

CONVEYORS & ELEVATORS
Fraser & Chalmers Eng'g Wks.
Head Wrightson & Co. Ltd.
Wood (Hugh) & Co. Ltd.

CRANES
Butterley Co. Ltd.
Ward (Thos. W.) Ltd.

CRAWLER TRACTORS
Abelson & Co. (Engineers) Ltd.
Blackwood Hodge (J.) & Co. Ltd.
Marshall Sons & Co. Ltd.
Olding (Jack) & Co. Ltd.

CRUSHERS — JAW
Baxter (W. H.) Ltd.
Fraser & Chalmers Eng'g Wks.
Hadfields Ltd.
Head Wrightson & Co. Ltd.
Holman Bros. Ltd.

CRUSHERS — GYRATORY
Hadfields Ltd.

CRUSHING ROLLS
Hadfields Ltd.
Head Wrightson & Co. Ltd.

CYANIDE PLANTS
Denver Equipment Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Head Wrightson & Co. Ltd.
Knapp & Bates Ltd.

DIAMONDS — INDUSTRIAL
Smit (J. K.) & Sons Ltd.
Triefus Ltd.
Van Moppes (L. M.) & Sons Ltd.
Wolverhampton Diamond Die & Tool Co. Ltd.

DREDGE BUCKETS
Hadfields Ltd.

DREDGES
Ruston Bucyrus Ltd.

DRILL BITS — DETACHABLE
Bedford (John) & Sons Ltd.
Rip Bits Ltd.
Holman Bros. Ltd.

DRILL BITS — DIAMOND
Craelius Co. Ltd.
Smit (J. K.) & Sons Ltd.
Triefus Ltd.
Van Moppes (L. M.) & Sons Ltd.

DRILL RIGS
Joy-Sullivan Ltd.

DRILL RODS
Bedford (John) & Sons Ltd.
Holman Bros. Ltd.
Rip Bits Ltd.
Wood (Hugh) & Co. Ltd.

DRILL SHARPENERS
Holman Bros. Ltd.

DRILL STEEL
Bedford (John) & Sons Ltd.
Consolidated Pneumatic Tool Co. Ltd.
Hadfields Ltd.

DRILLS — DIAMOND & CORE
Consolidated Pneumatic Tool Co. Ltd.
Craelius Co. Ltd.
Joy-Sullivan Ltd.

DRILLS — PROSPECTING
Associated Drilling & Supply Co. (Overseas) Ltd.
Ruston Bucyrus Ltd.

DRILLS — ROCK
Climax Rock Drill & Eng'g Wks. Ltd.
Consolidated Pneumatic Tool Co. Ltd.
Dollery & Palmer Ltd.
Holman Bros. Ltd.
Wood (Hugh) & Co. Ltd.

DUST COLLECTING PLANT
Howden (James) & Co. (Land) Ltd.

EARTH MOVING EQUIPMENT
Abelson & Co. (Engineers) Ltd.
Birtley Co. Ltd.
Blackwood Hodge (J.) & Co. Ltd.
Marshall Sons & Co. Ltd.
Olding (Jack) & Co. Ltd.
Premier Plant & Hire Co. Ltd.
Ward (Thos. W.) Ltd.

ELECTRIC MOTOR & CONTROL GEAR
British Thomson-Houston Co. Ltd.
English Electric Co. Ltd.
General Electric Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.

ELECTRICAL SWITCHGEAR
British Thomson-Houston Co. Ltd.
English Electric Co. Ltd.
General Electric Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
Wood (Hugh) & Co. Ltd.

ELECTRICAL PRECIPITATION
Lodge Cottrell Ltd.

EXCAVATORS
Blackwood Hodge (J.) & Co. Ltd.
Olding (Jack) & Co. Ltd.
Premier Plant and Hire Co. Ltd.
Ransomes & Rapier Ltd.
Ruston Bucyrus Ltd.

EXPLOSIVES — BLASTING
I.C.I. (Nobel Division)

EXTRUSIONS — ALUMINIUM
Southern Forge Ltd.

FILTERS
Denver Equipment Co. Ltd.

FILTERS — LUBRICATING OILS
Stream-Line Filters Ltd.
Tecalemit Ltd.

FILTERS — SWITCH & TRANSFORMER OIL
Stream-Line Filters Ltd.

FIRE EXTINGUISHERS
Nu-Swift Ltd.

FIRST AID EQUIPMENT
Cuxon Gerrard & Co. Ltd.

FLEXIBLE JOINTS
The Unicone Co. Ltd.

FLOTATION EQUIPMENT
Birtley Co. Ltd.
Denver Equipment Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Knapp & Bates Ltd.

FLOTATION REAGENTS
I.C.I. (Gen. Chem. Div.)
Robinson Bros. Ltd.

FORGINGS — ALUMINIUM
Southern Forge Ltd.

FOUNDATIONS
Cementation Co. Ltd.

GEOPHYSICAL INSTRUMENTS
Hilger & Watts Ltd.

GEOPHYSICAL & GEOLOGICAL SURVEYS
Associated Drilling & Supply Co. (Overseas) Ltd.
Craelius Co. Ltd.
Thom (John) Ltd.

GRINDING PANS
Fraser & Chalmers Eng'g Wks.
Holman Bros. Ltd.

HAULAGE GEAR
Austin Hopkinson & Co. Ltd.
Holman Bros. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.

HELMETS
Helmets Ltd.
Malcolm Campbell (Plastics) Ltd.

HEADGEARS
Head Wrightson & Co. Ltd.

HOISTS
Austin Hopkinson & Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Holman Bros. Ltd.

HOSE — RUBBER
British Tyre & Rubber Co. Ltd.
Dominion Rubber Co. Ltd.
Goodyear Tyre & Rubber Co. (G.B.) Ltd.

LAMPS — MINERS
Metropolitan-Vickers Electrical Co. Ltd.

LOCOMOTIVES — DIESEL
Hill (C. M.) & Co. Ltd.
Hunslet Engine Co. Ltd.
North British Locomotive Co. Ltd.
Ruston & Hornsby Ltd.
Wood (Hugh) & Co. Ltd.

LOCOMOTIVES — ELECTRIC
English Electric Co. Ltd.
British Thomson-Houston Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.

LOCOMOTIVES — STEAM
Hill (C. M.) & Co. Ltd.
Hunslet Engine Co. Ltd.
North British Locomotive Co. Ltd.
Ruston & Hornsby Ltd.

LUBRICATION — MECHANICAL
Tecalemit Ltd.

MAGNETIC SEPARATORS
Davies Magnet Works Ltd.
Rapid Magnetic Machines Ltd.

MINE CARS
Butterley Co. Ltd.
Hill (C. M.) & Co. Ltd.
Hunslet Engine Co. Ltd.

MINE CAR — WHEELS & AXLES
Hadfields Ltd.
Wild (A. G.) Ltd.

PICKS — PNEUMATIC
Consolidated Pneumatic Tool Co. Ltd.
Dollery & Palmer Ltd.
Holman Bros. Ltd.
Wood (Hugh) & Co. Ltd.

PIT PROP EXTRACTORS
Wild (A. G.) Ltd.

PLANT — HIRE
Abelson & Co. (Engineers) Ltd.
Premier Plant & Hire Co. Ltd.
Ward (Thos. W.) Ltd.

PUMPING EQUIPMENT
Comet Pump & Eng'g Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Holman Bros. Ltd.
Sigmund Pumps Ltd.
Ward (Thos. W.) Ltd.

PUMPS — CENTRIFUGAL
Comet Pump & Eng'g Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Sigmund Pumps Ltd.
Ward (Thos. W.) Ltd.

PUMPS — GRAVEL
Consolidated Pneumatic Tool Co. Ltd.
Denver Equipment Co. Ltd.
Ruston Bucyrus Ltd.

PUMPS — SAND
Denver Equipment Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Wilfley Mining Machinery Co. Ltd.

PUMPS — SINKING
Sigmund Pumps Ltd.
Thom (John) Ltd.

RAILWAY PLANT & EQUIPMENT
Ward (Thos. W.) Ltd.

RESPIRATORS
Siebe Gorman & Co. Ltd.

RUBBER PRODUCTS
British Tyre & Rubber Co. Ltd.
Dominion Rubber Co. Ltd.
Goodyear Tyre & Rubber Co. (G.B.) Ltd.
Rubber Improvement Ltd.

SAFETY EQUIPMENT
Malcolm Campbell (Plastics) Ltd.
Safety Products Ltd.
Siebe Gorman & Co. Ltd.

SCRAP SHEARS
Morrison Marshall & Hill Ltd.

SCRAPER HAULAGE
Austin Hopkinson & Co. Ltd.
Holman Bros. Ltd.
Wood (Hugh) & Co. Ltd.

SCRAPER LOADERS
Joy-Sullivan Ltd.

SCREENING PLANT
Birtley Co. Ltd.
Davies Magnet Wks. Ltd.
Fraser & Chalmers Eng'g Wks.
Head Wrightson & Co. Ltd.

SHAFT SINKING
Cementation Co. Ltd.

SHOVEL LOADERS
Joy-Sullivan Ltd.

STAMP BATTERIES
Head Wrightson & Co. Ltd.

SURVEYING INSTRUMENTS
Hilger & Watts Ltd.

THICKENERS
Denver Equipment Co. Ltd.

TIMBER PRESERVATIVES
Hicksons Timber Impregnation Co. (G.B.) Ltd.

TRANSFORMERS
British Thomson-Houston Co. Ltd.
English Electric Co. Ltd.
General Electric Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.

TUBE BENDING MACHINES
Chamberlain Industries Ltd.

TUBE MILLS
Head Wrightson & Co. Ltd.
Wilfley Mining Machinery Co. Ltd.

TURBINES — STEAM
Richardsons Westgarth (H'pool) Ltd.

VENTILATING FANS
Howden (James) & Co. (Land) Ltd.

VEE-ROPE DRIVES
Wigglesworth (F.) & Co. Ltd.

WAGONS
Butterley Co. Ltd.
Head Wrightson & Co. Ltd.

WATER SUPPLY EQUIPMENT
Associated Drilling & Supply Co. (Overseas) Ltd.
Thom (John) Ltd.

WELDING
Cementation Co. Ltd.

WELDING ELECTRODES
Metropolitan-Vickers Electrical Co. Ltd.

WELDING EQUIPMENT — ELECTRIC ARC
English Electric Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.

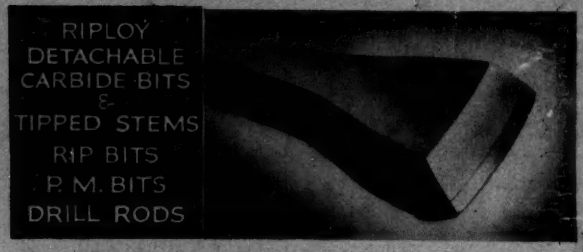
WIRE ROPE & ACCESSORIES
British Ropes Ltd.

WINDING EQUIPMENT — ELECTRIC
British Thomson-Houston Co. Ltd.
English Electric Co. Ltd.
Fraser & Chalmers Eng'g Wks.
Metropolitan-Vickers Electrical Co. Ltd.

What's under *your* hat ?

All the good ideas aren't under one hat, you'll agree. At times of crisis, especially, two heads (or more) are infinitely better than one. Snags occasionally crop up which baffle even the most experienced man on the spot and the fresh approach of an informed outsider is called for. That's where our technical advisory service comes in useful. So often, by putting our heads together with yours, the trickiest problems can be solved. Don't hesitate to call us in.

A Bit for EVERY drilling job



RIP BITS LIMITED

R B

A Subsidiary of PADLEY & VENABLES LTD., Sheffield and Birmingham.
HILL STREET, SHEFFIELD 2 Telephone: 26706

London Office:
66 Victoria Street, London, S.W.1
Telephone: TATe Gallery 0752/3

HUWOOD

TOP & BOTTOM LOADING BELT CONVEYORS

Conveyors for every output.

HUWOOD

Conveyors for every output.

Head Office & Factories:
HUGH WOOD & CO. LTD., GATESHEAD - ON - TYNE 11.
Industrial & Export Office:
DASHWOOD HOUSE, 69, OLD BROAD STREET, LONDON, E.C.2.
TELEPHONE: LONDON WALL 6631-2-3 TELEGRAMS: HUWOOD, AVE, LONDON.

Published by The Mining Journal Ltd., 15 Wilson Street, Moorgate, London, E.C.2, and printed by Washburn & Sons Ltd., 25-27 Queens Road, Southend-on-Sea, Essex. Registered as a Newspaper.